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DOBBS (C. G.). **On the primary dispersal and isolation of fungal spores.**—*New Phytol.*, xli, 1, pp. 63–69, 1 fig., 1942.

In discussing the dispersal methods of fungal spores in air and water, distinctions are drawn between primary dispersal, by which the spore is carried away from the parent body, and secondary dispersal, which applies to all subsequent distribution after the spore has once come to rest; and also between active dispersal, when the fungus supplies the initial energy, and passive dispersal due to movements or actions of the surrounding medium or other organisms, e.g., insects. Passive spore dispersal in the air was studied with the aid of a simple insufflator (blower) by means of which spores were blown gently in still air and the fungi were tentatively grouped according to type of dispersal as follows: (1) spore-retainers (the least numerous group), which shed no spores in air under any circumstances; (2) spore drop-shedders, which are spore-retaining in general, but scatter spore-containing drops when moist and subjected to rather strong blowing or shaking of their support; (3) dried spore-shedders, which shed few or no spores when moist, but many when dry and subjected to gentle blowing; and (4) spore-shedders (the most numerous group), which shed some spores in still air as soon as they are produced on the moist colony, and many more when subjected to gentle blowing. Methods of spore dispersal were also grouped according to the parts played by water and air in the process, namely, group 1, dispersal of spores immediately by water; group 2, by air bubbles in water as in working yeasts; group 3, dispersal of spores in spore drops or slimy masses by natural water; group 4, dispersal of spore drops in air by (*a*) animals or other solid objects, and (*b*) air currents or shaking of their support; group 5, dispersal of spores by air from spore drops that have dried *in situ*; and group 6, dispersal of individual spores by air, each directly from its own point of attachment.

The blower mentioned above consists of a Pyrex glass tube containing a plug of cotton wool and provided with a rubber bulb at one end and two prongs of tungsten wire fused into the other end. After flaming the wire and adjacent parts, a tuft of aerial mycelium is picked up by the prongs, or a piece of culture medium placed on them, or the sporing surface of a culture is touched with sterile cotton wool borne on the prongs. The end of the tube is then inserted under the lid of a Petri dish and one gentle puff is all that is needed to inoculate the medium. The method provides a simple means of isolating spores and separating spore-shedding fungi from spore-retaining ones or from moist bacterial colonies.

MELCHERS (L. E.). **Climate in relation to plant diseases.**—*Trans. Kans. Acad. Sci.*, xliv, pp. 172–182, 1 graph, 1941.

Following a general survey of the relation of environmental factors to plant diseases, the writer cites a few examples of the influence of soil and meteorological conditions on the development and distribution of some important fungal pathogens in the

United States. Onion smut [*Urocystis cepulae*], first detected in Massachusetts 50 years ago, and now widespread in the north, is spread by means of diseased bulbs, especially sets, yet these are annually introduced into Louisiana and Texas without giving rise to serious infection, since the soil temperatures prevailing in those States during the critical germination period of the seed are above the maximum (29° C.) for the growth of the fungus [*R.A.M.*, xviii, p. 367], which can only enter its host below ground and through the young parts of the cotyledonary leaf.

The optimum temperature for the vegetative development of flax is 20°, while severe attacks of the wilt fungus [*Fusarium lini*] are favoured by a range from 24° to 28°, so that the absence of the disease from fields with soil temperatures of 12° or 38° (the minimum and maximum for the growth of the host) may be partially due to conditions adverse to the parasite, while on the other hand, the host may undergo certain changes at these points tending to confer resistance.

The fact that wheat bunt [*Tilletia caries* and *T. foetida*] will occur in one field and not in another across the road, or even in only one part of the same field, assuming the same seed to have been used, is undoubtedly attributable to the variations in soil temperatures resulting from sowing on different dates. In 1926 at Manhattan, for instance, no infection developed in plantings of Kanred sown on 4th and 11th September, when the average soil temperatures for the seven days after sowing were 75·30° and 70·25° F., respectively, whereas the incidence in the plantings sown on 9th and 31st October and 7th November at temperatures of 46·60°, 38·21°, and 35·78°, respectively, was 79·65, 71·12, and 82·84 per cent., respectively. This knowledge has an important bearing on the programme of breeding bunt-resistant varieties, an essential feature of which is the planting of the material at the critical period in each autumn for the establishment of the pathogens. Careful study of the soil-air thermograph charts with the above-mentioned facts in mind insures the planting of the bunt nursery at the correct time. In this connexion it is of interest to note that the autumn of 1940 was unusually warm, and by 16th June, 1941, it was evident that bunt would be of minor importance in the State. Excellent infection, however, was obtained in the bunt nursery, the planting of which was deferred until the advent of cooler conditions.

The immediate lowering of the soil and air temperatures of tomato greenhouses to below 77° on the detection of the wilt fungus [*F. bulbigenum* var. *lycopersici*: see below, p. 393] will partially or completely save the crop, since the pathogen develops most rapidly at 88°. The following year resistant varieties should be grown or the soil sterilized to destroy the fungus.

Potato scab [*Actinomyces scabies*] is very severe in soils with a moisture content of 14 per cent. at the time of tuber-setting, whereas at 34 per cent. the disease is absent. The writer has followed the development of a 400-acre peat farm in Minnesota, the reclamation of which from a swamp was begun in 1914: by 1924 partial drainage had been effected, and for the first three years excellent potato crops were produced, but as the water table gradually sank from its original high level, only 14 to 18 in. below the surface, scab became prevalent and caused extensive deterioration in the yield and quality. In 1931, at the writer's suggestion, a steel flood-gate was installed in the main ditch at the outlet, the water in which was regulated in the spring and summer so as to back up the water into the tile lines and raise the water table of the land. The first year after this step was taken the disease almost disappeared, and since then it has never occurred in sufficient abundance to reduce the market grade below U.S. No. 1.

Studies on the wheat scab and maize seedling blight caused by *Gibberella saubinetii* have shown that wheat seedlings contract infection in a warm soil but not in a cold one, while those of maize react positively to infection in a cold but not in a warm soil. This is an instance of the environment affecting the host and thereby modifying its response to the parasite. The latter is at its best at a high temperature, and it is the

chemical changes taking place in maize seedlings under cool conditions that stimulate the fungus, which is actually weaker than usual. On the other hand, in the case of wheat scab, the host is enfeebled and the pathogen fortified by high temperatures, with the results that would be expected.

Another instance of the effect of a change in environment on the parasite-host relationship is afforded by Marquis (spring) wheat, which is highly resistant to bunt when sown at its normal time in the spring, but becomes susceptible on planting in the autumn, a practice sometimes adopted in warm climates [ibid., xxi, p. 133].

Loose smut of wheat [*Ustilago tritici*] has steadily increased in the hard wheat belt of Kansas during the last seven years, apparently owing to the abnormally heavy precipitation during that period, though the possibility of the development of new physiologic races of the smut cannot be excluded.

The author's observations on the relation of environmental conditions to recent outbreaks of stem rust of wheat [*Puccinia graminis*] have been summarized from another source [ibid., xxi, p. 248]. A statement of interest in this connexion is that the Hope variety, used as a source of resistance in wheat-breeding programmes, exhibits virtually no trace of this property when grown in the fog belt of Peru, showing the adverse effect of low light intensity.

Bean [*Phaseolus vulgaris*] anthracnose [*Colletotrichum lindemuthianum*] may be largely controlled by the use of healthy seed, now obtainable from the arid regions of Idaho, Montana, and California, where the crop is extensively grown under irrigation and thrives better than in the more humid climates of the east and middle west.

Lindegren (C. C.). **The use of the fungi in modern genetical analysis.**—*Iowa St. Coll. J. Sci.*, xvi, 2, pp. 271–290, 1 diag., 1942.

Although fungi are pre-eminently adapted for genetical experiments, they have been much less frequently used for this object than *Drosophila* and maize owing to the inapplicability to such widely different organisms of the methods in common use. With a view to elucidating the problems incidental to the genetical analysis of fungi, the writer outlines some important aspects of their cytology and modes of inheritance, with special reference to his work on *Neurospora* (chosen on account of its short life-cycle, permitting the development of mature offspring in two to three weeks after mating), including hyphal fusion, heterokaryosis, asexual and sexual cycles, segregation in the ascus, chromosome maps and chromosomes, homokaryotic strains, production of mutations in fungi, techniques for the separation of heterokaryons, variety of mutant forms, classification of progeny by elimination, aberrant segregation ratios, tetrad analysis, and X-ray and ultra-violet-induced mutation.

Hildebrand (E. M.) & Curtis (O. F.). **A darkening technique for inducing virus symptoms in mature as well as in growing leaves.**—*Science*, N.S., xcv, 2467, p. 390, 1942.

In experiments on the transmission of the yellow-red virosis or 'X' disease of peach [*R.A.M.*, xx, p. 540] it was found that darkening the upper half of young, rapidly growing peach seedlings, which had received a diseased bud midway on the stem, induced symptoms in the shaded part sometimes within four weeks from the time the shading began. Similarly, darkening one of the branches of older non-growing seedlings, which had received a diseased bud near the base of the branch, induced symptoms within six weeks. In both cases the shading was maintained for only two weeks and it is believed that this time can be still further reduced. As an explanation of the observed facts, it is suggested that the movement of the virus in the plant is associated with that of carbohydrate. Shading a portion of a plant stops photosynthesis in that part and favours the transport of carbohydrate from the unshaded into the shaded parts. When, on its way, the food passes a diseased bud, it receives and carries the virus along into the shaded part of the plant. It is suggested that temporary darken-

ing to induce entrance of the virus and the development of disease symptoms in non-growing as well as growing tissues represents an important transmission technique for the study of plant viruses.

JOHNSON (J.). **Studies on the viroplasm hypothesis.**—*J. agric. Res.*, lxiv, 8, pp. 443–454, 7 figs., 1942.

Inoculation experiments described in this paper were designed to test the hypothesis, referred to as the 'viroplasm hypothesis', that some part of the normal protoplasm of one species of plant, introduced into the cells of another, might find conditions compatible for growth and cause the abnormality known as virus disease [*R.A.M.*, v, p. 120]. The results obtained are stated to have yielded no positive proof in support of this hypothesis, but have suggested new lines of research and revealed the existence of two hitherto undescribed viruses.

When extracts from healthy plants of 122 species of legumes representing 50 genera were transmitted by the wiping method of inoculation to bean [*Phaseolus vulgaris*] and certain other test plants, 119 developed no symptoms. Of the remaining three, *Lathyrus tingitanus* regularly produced symptoms which are, however, believed to be an allergic response, and *L. pusillus* and *Sesbania macrocarpa* each yielded a new virus, here described for the first time under the common names of 'bean leaf wilt virus' and 'bean yellow necrosis virus', respectively. The symptoms produced by the former on Refugee bean are largely limited to the primary inoculated leaves, which usually wilt and dry up without developing necrotic lesions. The virus is transmissible by *Myzus persicae*; its thermal death point is 48° to 50° C. at 10 minutes' exposure; it tolerates ageing *in vitro* for 24 hours and in dried leaves for 30 days and withstands a dilution of over 1 to 1,000. The second virus described was secured in two separate trials, but not in several others; it causes marked yellowing and necrosis on Refugee bean. Other susceptible species are soy-bean and garden pea (Marvel variety). The virus is not transmissible by *M. persicae*; its thermal death point is 49° at 10 minutes' exposure, it survives ageing *in vitro* for 48 hours and possibly longer and in dried leaves for 12 days or more; it tolerates a dilution of 1 to 100,000 and possibly 1 to 500,000; it was removed from filtrates by both Mandler and Seitz filters and was not inactivated by cow's milk. It is presumed that these two viruses pre-existed in the hosts and did not originate as a result of the transfer of healthy protoplasm to another species.

HOW (MISS J. E.). **The mycorrhizal relations of Larch. II. The role of the Larch root in the nutrition of Boletus elegans Schum. III. Mycorrhiza formation in nature.**—*Ann. Bot., Lond.*, N.S., v, 17, pp. 121–131, 1 pl., 1941; vi, 21, pp. 103–129, 1 pl., 1 fig., 2 graphs, 1942.

In further studies of mycorrhizal formation in larch [*R.A.M.*, xix, p. 297] reported in the second paper of this series, the part played by larch roots as a nutrient source for *Boletus elegans* was investigated by adding excised root tips of conifer seedlings to pure cultures of the fungus. It was found that a growth-promoting substance or a substance complex was present in the primary roots of European and Japanese larch, but not in those of Scots pine. It was demonstrated that the main constituents of the growth promoter are soluble in water, but no further information on its nature could be gained. Microscopic examination of root-fungus cultures revealed a semi-parasitic invasion of the roots by the fungus, which appeared to have penetrated into the root cells by means of pressure from the growing mycelium.

The main body of the third paper is devoted to the formation of mycorrhiza in nature, while in an appendix an unsuccessful attempt to induce mycorrhiza formation with cultures of *B. elegans* and *Paxillus involutus* is described.

Measurements of roots of European larch showed that there are two distinct types, sublateral or short ones which normally form mycorrhiza, and lateral or long ones

which are infected very occasionally and then develop atypical mycorrhiza. Detailed descriptions are given of the structural features of mycorrhizal infections with seven fungi most commonly associated with the roots of larch, namely, *B. elegans*, *P. involutus* (both isolated from true mycorrhiza), *Mycelium radicis atrovirens* (isolated from pseudo-mycorrhiza), *B.* (?) *viscidus*, a yellow hymenomycete mycelium, and two unidentified mycelia. Sublateral roots infected with *B. elegans* (and the same is believed to apply to all true mycorrhiza-forming fungi) were found to show an increased number of cells in the cortex, the cells becoming oblong probably as a result of cell division. The following structural features are believed to be typical of a 'balanced' mycorrhizal association in larch. The mantle, varying in width from 10 to 70 μ, consists of hyphae closely woven together in a manner characteristic of the fungus concerned. It encloses two or three layers of dead cortical cells, within which is a single layer of mainly squarish tannin cells with a few granular cells. The Hartig net extends across the outer cortex to the inner cortex and the cell walls are not swollen and contain only one strand of hyphae. The oblong outer cortical cells number at least 60. Intracellular infection is absent. Deviations from this structure are clearly due to the growth of the fungus at the root's expense and comprise very wide fungal mantles containing isolated cortical cells, very swollen cortical walls with two or more strands of hyphae and intracellular infection. Occasionally the reverse obtains and the fungus finds difficulty in establishing itself, as shown by the almost complete absence of the mantle and Hartig net. Under natural conditions, a sublateral root may remain uninfected (an infrequent occurrence) and unbranched, be infected by *B. elegans* or other mycelia to form a balanced association, form an unbalanced association with one of the mycorrhizal fungi, or be attacked by certain 'black' fungi which tend to form only pseudo-mycorrhiza.

FRIES (N.). **Einspormyzelien einiger Basidiomyceten als Mykorrhizabildner von Kiefer und Fichte.** [Monospore mycelia of some Basidiomycetes as mycorrhiza-formers on Pine and Spruce.]—*Svensk bot. Tidskr.*, xxxvi, 2–3, pp. 151–156, 2 figs., 1942.

At the Institute for Physiological Botany, Upsala, in 1940–1, the author conducted synthetic experiments, substantially on the lines adopted by Melin in similar studies [*R.A.M.*, iii, pp. 358, 540; xviii, p. 541], with monospore mycelia. Four mycorrhiza-forming Basidiomycetes, viz., *Tricholoma pessundatum* [ibid., xviii, p. 542], *Boletus granulatus*, *B. luteus* [ibid., xviii, p. 406], and *Scleroderma aurantium*, were grown in flasks containing an acid nutrient solution (potassium dihydrogen phosphate) in contact with pine seedlings and the first- and last-named also with spruce, a total of 80 cultures being maintained. A parallel series of tissue cultures of one- to two-year-old mycelia of the same organisms was also run. At the conclusion of the test, after a period ranging from three to nearly five months for the several species, *T. pessundatum* was found to have produced an abundance of hyphae on the collar of the lateral roots. Mycorrhiza were more numerous on the pine than on the spruce seedlings, and were usually unbranched. The hyphae of *B. granulatus* made luxuriant growth, numerous mycorrhiza being formed on the pine roots, mostly in the form of single, occasionally in that of double forks. *B. luteus* did not develop so profusely as the foregoing, but two of the monospore mycelia gave rise to distinctly furcate mycorrhiza in all eight flasks containing pine seedlings. Hyphal growth in the case of *S. aurantium* was sparse, but each of the three monospore mycelia formed mycorrhiza on pine in at least one flask, only one, however, being similarly active on spruce (in two flasks). The mycorrhiza produced vigorous, white hyphal strands. Hyphal mantles, Hartig's network, and other typical anatomical features were observed in the mycorrhiza of all four fungi. None of the organisms was investigated in relation to its sexuality, but it is almost certain that the monospore mycelia of *S. aurantium* are haploid.

MELIN (E.) & NORKRANS (BIRGITTA). **Über den Einfluss der Pyrimidin- und der Thiazolkomponente des Aneurins auf das Wachstum von Wurzelpilzen.** [On the influence of the pyrimidin and thiazol components of aneurin on the growth of root fungi.]—*Svensk bot. Tidskr.*, xxxvi, 2–3, pp. 271–286, 4 graphs, 1942.

In further studies on the auxin requirements of mycorrhizal fungi [*R.A.M.*, xviii, p. 542], aneurin was shown to be replaceable by its pyrimidin and thiazol components in equimolar quantities in synthetic cultures of *Paxillus prunulus*, *Amanita pantherina*, *Tricholoma albobrunneum*, *Boletus granulatus*, and *B. variegatus*. Thiazol alone stimulates the growth of *B. luteus* and *B. piperatus*, though not so actively as in conjunction with pyrimidin, while the latter may be substituted for aneurin in the case of *Cenococcum graniforme*. The development of *Mycelium radicis atrovirens* [ibid., xviii, p. 700], which is aneurin-autotrophic, is retarded by the addition to the medium of aneurin or its components, especially pyrimidin alone or mixed with thiazol.

SAVILE (D. B. O.). **Alteration of Potato starch grain structure under the influence of disease.**—*Amer. J. Bot.*, xxix, 4, pp. 286–287, 6 figs., 1942.

Malformed starch grains, presumably resulting from an abnormal function of the leucoplasts, were found in 1939 in potato tubers affected by various fungus pathogens (including *Phytophthora infestans*), virus diseases, and environmental disorders. They were particularly abundant in tubers examined at harvest time and scarcer in those stored for the following winter. These grains are not eroded by hydrolysis. The leucoplast appears to become increasingly degenerate during the formation of the grain, as the hilum can be found close to the more normal end. The leucoplasm eventually ruptures on the thin side of the grain and then withdraws to the opposite side. The subsequent starch deposition takes the form of caps or segments, one upon another, giving the grain a larva-like appearance. Abnormal nuclear division, not connected with phellogen formation, was also observed, three, four, or even five nuclei being often seen in a single cell.

IVERSON (V. E.) & HARRINGTON (F. M.). **Accuracy of the ultra-violet-light method for selecting ring rot free Potato seed stocks.**—*Amer. Potato J.*, xix, 4, pp. 71–74, 1942.

The results of greenhouse tests conducted in 1941 at the Montana Agricultural Experiment Station to compare the accuracy of the ultra-violet light and Gram stain methods for the selection of Netted Gem potato seed stocks free from bacterial ring rot [*Corynebacterium sepedonicum*: *R.A.M.*, xxi, p. 263] showed the former to be equally effective with the latter and to be carried out in less than one-tenth of the time required for the stain, while a further advantage of the ultra-violet light was its elimination of tubers showing brown vascular discoloration.

[BEELEY (F.).] **Pests and diseases.**—[*Abridged*] *Rep. Rubb. Res. Inst. Malaya, 1940*, pp. 10–12, 1941.

The results obtained [by R. P. N. Napper] in 1940 on the control of *Hevea* rubber root disease (*Fomes lignosus*, [*F. noxius*, and *Ganoderma pseudoferreum*]) necessitate the modification of some of the practical recommendations previously made in connexion with replanting [*R.A.M.*, xx, p. 34]. For instance, it is unnecessary to dig over the open central areas of infected patches in the old stand, the removal of the roots of trees known to be diseased sufficing, except where replanting is expected to be deferred for a considerable period, in which case annular zones at least 25 ft. wide must be thoroughly cleaned up round the margins to obviate the reinfection of the surrounding mature trees. Small patches not destined for replanting should be completely dug over.

For controlling root disease in areas showing no evidence thereof in the old stand,

poisoning by means of frill-girdling or stump injections [with sodium arsenite] is a cheap and effective method of clearing healthy trees where the incidence of *F. lignosus* after replanting is known to be low, and may appropriately replace felling in sites on steeply sloping ground, where soil disturbance must be reduced to a minimum. The most economical procedure of allowing the frill-girdled trees to decay *in situ*, thereby prolonging the tapping period up to or even beyond the time of replanting, involves a risk to human life from the falling crowns which cannot be disregarded. A prevalent misconception with regard to the poisoning treatment should be corrected: it does not destroy the agent of root disease in the infected roots, but kills the healthy living ones whereby the pathogen is spread.

Sun scorch of the tapping panel was unusually widespread in consequence of the abnormal drought, and palm oil was tested as a palliative with promising results. The incidence of pink disease [*Corticium salmonicolor*] was fairly high in some districts during the wet season, but mildew (*Oidium*) [*heveae*] was conspicuous by its virtual absence owing to the ideal wintering and refoliation conditions prevailing in the early part of the year.

HOERNER (G. R.). **A convenient scale for use in the rapid determination of comparative degrees of infection of Hops by the downy mildew fungus, Pseudoperonospora humuli.**—*Phytopathology*, xxxii, 4, pp. 331–333, 2 figs., 1 diag., 1942.

Excised hop leaves are placed on moistened disks of filter paper in the bottoms of Petri dishes and the exposed lower surfaces atomized with distilled water suspensions of the downy mildew fungus, *Pseudoperonospora humuli*. The moist chambers thus prepared are transferred to an incubation cabinet, in which the optimum germination temperature of 65° F. is maintained, for an appropriate period, after which clumps of sporangiophores bearing dark-coloured sporangia appear on the foliage of a susceptible host, such as the Late Clusters hop variety. The scale devised for the rapid determination of comparative degrees of infection consisted of traced outlines of a hop leaf of convenient size to fit into the Petri dish, each containing a given number of dots, from 0 to 100, to represent points of infection, the incidence of which is shown by a graduated range of numerals from 0 to 100.

TUNSTALL (A. C.). **Red rust.**—*Mem. Tocklai Exp. Sta. Indian Tea Ass.*, 14, 19 pp., 5 pl. (3 col.), 1942.

The last comprehensive discussion on red rust of tea (*Cephaleuros parasiticus*) published by the Indian Tea Association was the revised edition of Mann and Hutchinson's paper on the subject (1904). The writer well remembers, 25 or 30 years ago, the serious depredations caused by the blight, frequently involving losses of 10 to 15 per cent. of the crop, but the gradual recognition of the requirements of the host and the consequent improvement in cultural operations reduced the incidence of the disease in north-east India to a minimum until the recent introduction of restriction brought about the replanting of extensive areas of impoverished soil. Now that the parasite has again become prevalent under these unfavourable conditions, it was considered advisable to present this new account of the disease and recommendations for its control, the latter problem resolving itself into the maintenance of the host in a resistant state, since the total elimination of such a widespread organism as the alga under discussion is impracticable.

Although lack of soil moisture, combined with other adverse factors, such as poor aeration, undue reduction in leaf area, and excessive alkalinity, is the predisposing cause of susceptibility to red rust, spraying with 1 per cent. Burgundy mixture plus a rosin adhesive or 0·25 per cent. perenox (4 oz. per 10 gals.) proved to be a useful palliative in experiments at Borbhetta in the summer of 1938, while in 1940 perenox exerted a beneficial effect (still persisting nearly a year later) when applied in early

June at a concentration as low as 0·125 per cent. (2 oz. per 10 gals.). Light-leafed tea appears to be more susceptible to infection by *C. parasiticus* than dark-leafed.

Discussing the taxonomy of the agent of red rust, the writer prefers the name *C. parasiticus* Karst. to those of *C. mycoidea* Karst. or *C. virescens* Kunze, the last being singularly inapt since the pathogen imparts a red tinge to the foliage in place of its normal green. No significant difference was observed between the fructifications of the parasitic and purely epiphytic forms of the alga, but *C. parasiticus* is obviously a more appropriate name for the agent of the tea disease than *C. mycoidea*. Another unhappy misnomer is the common name of 'red rust', suggesting as it does a non-existent resemblance to wheat rust. The coloured plates are a feature of the paper.

SPENCER (E. L.). **Specific biological activity of Tobacco-mosaic virus as influenced by age of lesion and nitrogen supply.**—*Plant Physiol.*, xvii, 2, pp. 210–222, 2 graphs, 1942.

A partial summary of the results of the writer's experiments on the relation of the nitrogen supply to the multiplication of the tobacco mosaic virus in the inoculated leaf has already been published [*R.A.M.*, xxi, p. 50]. In further studies, calculations from sedimentation rates in the analytical ultracentrifuge indicated that virus preparations from young lesions (five days after inoculation) may contain some particles (about one-third of the total) nearly double the length of the one component detected in 20-day-old lesions, which was also present in the young material. The second component under observation appears to be distinct from that observed by Wyckoff [ibid., xvi, p. 207], the development of which was attributed to protracted contact in storage with the buffer salts used as a solvent.

LORING (H. S.). **The reversible inactivation of Tobacco mosaic virus by crystalline ribonuclease.**—*J. gen. Physiol.*, xxv, 3, pp. 497–505, 1 fig., 1 graph, 1942.

Experiments showed that a ribonuclease concentration of $1{\cdot}2 \times 10^{-9}$ gm. per ml. exerts little or no effect on the activity of tobacco mosaic virus concentration of 10^{-5} gm. per ml. A decrease in activity was registered with a concentration of $1{\cdot}2 \times 10^{-8}$ gm. ribonuclease per ml., but the effect was not pronounced until a concentration of $1{\cdot}2 \times 10^{-7}$ or $1{\cdot}2 \times 10^{-6}$ gm. per ml. was reached. It was concluded that the inactivation of the tobacco mosaic virus with ribonuclease is comparable to that found for other proteins with high isoelectric points, and is thought to be related to the formation of complexes between oppositely charged protein particles. The solubility in salt or slightly acid or alkaline solutions suggests either partial or complete dissociation under these conditions.

GLASSTONE (VIOLETTE F. C.). **Study of respiration in healthy and mosaic-infected Tobacco plants.**—*Plant Physiol.*, xvii, 2, pp. 267–277, 2 figs., 3 graphs, 1942.

The writer describes the six-unit apparatus and the technique used in comparative studies at the Rockefeller Institute for Medical Research in the respiration rates of healthy and mosaic-diseased Samsun tobacco plants grown in a slightly modified formula of Hoagland and Arnon's nutrient solution (*Circ. Calif. agric. Exp. Sta.* 347, 1939) from the time of inoculation until the appearance of the mottling symptoms, an average period of a fortnight. The respiration ratio of diseased and healthy plants remained at the same level until vein-clearing became noticeable, after which the velocity of respiration of the inoculated plants rose rapidly until it exceeded that of the sound ones by 50 per cent., and then sank to a level about equal to that of the latter series by the time mottling became apparent. The intensified rate of respiration coinciding with the establishment of systemic infection in the diseased plants is considered to point to a corresponding increase in metabolic activity. The results obtained by the author and other investigators all indicate that the period of the clearing of the veins corresponds to the rapid movement and increase of the virus.

WELLMAN (F. L.). **Difference in P_H relations of some pathogenically variable strains of Tomato Fusarium.**—*Phytopathology*, xxxii, 4, pp. 271–287, 2 graphs, 1942.

In further studies on the comparative virulence of different isolates (79 in all) of the tomato wilt fungus (*Fusarium bulbigenum* var. *lycopersici*) [*R.A.M.*, xx, p. 236], adjudged by the reactions to inoculation of Bonny Best and Marglobe, a highly pathogenic strain produced its maximum weight in a liquid medium (Tochinai's formula) [ibid., xix, p. 170] in 12 days, while nearly twice this period was required by a mild isolate. In the liquid medium the former out-yielded the latter, whereas on a new differential agar substratum [the composition of which is indicated] the mild isolate covered a larger area. The optimum hydrogen-ion reactions for the development of the strongly and weakly pathogenic strains on the liquid medium were P_H 4·0 and 8·0, respectively, while on agar both grew best at a point slightly above neutral [ibid., ii, p. 347]. In a series of liquid media with a wide range of hydrogen-ion concentrations, cultures inoculated either with a mixture of mild and virulent strains or of actively saltating, unstable ones produced maxima at two different points. Under parallel conditions, the virulent and mild strains tended to induce alkaline and acid reactions, respectively, while those of intermediate pathogenicity produced results between these extremes.

TUCKER (C. M.). **The development of wilt resistant Tomatoes.**—*Proc. Mo. Acad. Sci.*, vii, 4, pp. 90–91, 1942.

Tomato wilt (*Fusarium* [*bulbigenum* var.] *lycopersici*) is widely distributed and destructive, especially in home gardens, in the latitude of Missouri and southwards. Of all the strains of *Lycopersicum esculentum* and *L. pimpinellifolium* tested for their reaction to the pathogen since 1933, only one, a Peruvian strain of the latter species, accession 160 of the United States Department of Agriculture, has remained free from infection during seven seasons under conditions inducing almost complete susceptibility in the commercial varieties. Crosses between the new strain and certain standard varieties resulted in F_1 hybrids with the resistance of *L. pimpinellifolium*, which was shown by the reactions of F_2 and back-cross progenies to be determined by a single genetic factor. Progenies of five generations of back-crossing to susceptible varieties have continued to segregate in the anticipated 1 resistant : 1 susceptible ratio, indicating that the resistance factor retains its potency unimpaired by association with numerous factors from the susceptible parent.

Three or more back-cross generations are usually necessary to secure plant and fruit characters approximating to those of superior commercial varieties, and three or more selfed generations are requisite for sufficient homozygosity to insure fairly uniform offspring, objects that have not yet been fully attained.

EATON (F. M.). **Toxicity and accumulation of chloride and sulfate salts in plants.**—*J. agric. Res.*, lxiv, 7, pp. 357–399, 5 figs., 4 graphs, 1942.

The results are given of experiments begun in 1934, in which the toxicity of chloride and sulphate salts to plant tissue was studied on a number of crops grown in large, outdoor, sand-culture beds. Blossom-end rot of tomatoes was found to develop in beds to which 50 or 150 milliequivalents of chloride per l. or 50, 150, and 250 of sulphate (affecting 7, 34, 2, 78, and 84 per cent. of plants, respectively) were added, while none occurred in the control plots. It is believed that neither unfavourable osmotic relations between the plants and solutions nor the accumulation of potassium or sodium can be regarded as a direct cause of the blossom-end rot induced by the treatments, but that calcium and magnesium accumulation singly or combined are important contributing factors.

HOWARD (F. L.). **The bleeding canker disease of hardwoods and possibilities of control.** —Reprinted from *Proc. eighth W. Shade Tree Conf.*, viii, 10 pp., 3 figs., 1941.

In addition to maples, already reported as hosts of *Phytophthora cactorum*, the agent of bleeding canker in Rhode Island and Massachusetts [*R.A.M.*, xix, p. 570], various species of beech, birch, elm, and oak have been found to suffer from the disease, the range of which is stated to extend from Maine to Florida and from Cape Cod to southern California. The symptoms of infection [loc. cit.] are similar in all the susceptible hardwoods. In preliminary tests of malachite green, helione orange, and other organic chemicals against the fungus, instead of adding the diluted chemical to the culture on wooden blocks, a more satisfactory result was obtained when the chemical was absorbed by a living tree, the tree cut down, and blocks from this dyed wood inoculated with *P. cactorum*. The fungus covered the unstained portions in seven days but stopped at the stained tissue. With the aid of a simple injection technique, whereby solutions can be taken up by the vascular tissues without the interference of air bubbles plugging the severed ends of xylem vessels, infiltration with 1 in 200 helione orange [cf. ibid., xiv, p. 590], a form of the di-hydro chloride salt of di-amino-azobenzene combined with an emulsifying agent in dilute acetic acid emulsion, was carried out in 1939 and 1940 on 338 maple and 13 beech trees, 299 (85·1 per cent.) of which made a complete recovery, judged by failure to reisolate the pathogen from the treated tissues. The fungus produces a toxic substance which was neutralized in experiments by helione orange at a strength of 1 in 500.

BONAR (LEE). **Studies on some California fungi. II.**—*Mycologia*, xxxiv, 2, pp. 180–192, 2 figs., 1942.

This annotated list of 19 fungi from California [cf. *R.A.M.*, xx, p. 323] contains the following new species of interest. *Mycosphaerella sequoiae* on leaves and young twigs of *Sequoia sempervirens* is described as having numerous perithecia, hypophyllous, rarely epiphyllous, scattered, single or clustered, subepidermal, globose, erumpent, 90 to 125 μ in diameter; fasciculate asci, elongate-cylindrical, slightly narrowed above, short-stipitate, 8-spored, 50 to 60 by 10 to 12 μ; fusiform-elliptical, hyaline, bicellular ascospores, 11 to 14 by 3 to 4 μ; and no paraphyses. The fungus infects the tips of the leaves and works back to the base, a high percentage of the leaves being killed and the foliage presenting a blasted appearance. *Diedickea piceae* on leaves of *Picea sitchensis* causes yellowing and discoloration with early leaf fall. It appears on the current season's foliage in the autumn, becoming conspicuous the following summer. The pycnidia separate from the yellowed leaf and fall off. They are amphigenous, scattered or crowded, entirely superficial, borne on a very thin subiculum of a meshwork of fine, hyaline hyphae with occasional larger brown ones, disciform, radiate, non-ostiolate, and 200 to 400 μ in diameter, and contain elliptical, hyaline, unicellular conidia, 2·5 to 3·5 by 1 μ, without conidiophores. *Dothichiza garryae* was found on living or dead leaves of *Garrya elliptica* and *G. flavescens* var. *buxifolia*. *Phyllosticta phoradendri* forms brown spots on leaves of *Phoradendron flavescens* var. *macrophyllum* on *Populus* sp., with pycnidia 125 to 200 μ in diameter and conidia 2 to 3·5 by 1 μ; it causes a conspicuous killing of the leaves.

A study of three fungi found growing on dead twigs of *Ilex aquifolium* showed that single-spore cultures of two of them, *Physalospora ilicis* and *Macrophoma ilicella*, were indistinguishable when grown under similar conditions; the latter is, therefore, considered to be a stage of the former fungus. Single-spore cultures of the third fungus, *Phoma ilicina*, differed from the first two in appearance and growth, and it is concluded that this fungus is distinct.

Polyporus sulphureus is reported to cause an extensive heart rot of the lower trunk and large roots of living *Eucalyptus globulus* in central California; one three-tiered sporophore of the fungus, 12 by 18 in. and 8 lb. in weight when fresh, was observed

to mature within 15 days after emergence. *Trochilia ilicis* (Chev.) Crouan, apparently uncommon in America, was collected on diseased or dead leaves of *Ilex aquifolium*.

Pomerleau (R.). **The spherical gall rust of Jack Pine.**—*Mycologia*, xxxiv, 2, pp. 120–122, 1 fig., 1942.

In addition to the two well-known types of gall rusts on Jack pine (*Pinus banksiana*), namely, the fusiform gall caused by *Cronartium comandrae* [*R.A.M.*, xviii, p. 73] and the effused gall of the base of the stem caused by *C. comptoniae* [ibid., xx, p. 614], a third type, a true globose gall, has been observed for several years in Quebec. Some galls of this type are considered to be related to those of *C. quercuum*, but not all, for they occur in northern regions, where oak, the alternate host, is from 200 to 300 miles distant; others appear more closely to resemble those due to *C. coleosporioides*. The teleuto stage of the latter rust was recently collected on *Melampyrum lineare*, and previously on other hosts. Pending definite proof of the relation between the rust on *M. lineare* and the spherical gall on Jack pine by direct inoculation, the author tentatively proposes the extension of the range of *C. coleosporioides* to eastern America and the addition of *P. banksiana* to its list of aecidial hosts.

Davidson (R. W.), Campbell (W. A.), & Weber (G. F.). **Ptychogaster cubensis, a wood-decaying fungus of southern Oaks and Waxmyrtle.** *Mycologia*, xxxiv, 2, pp. 142–153, 3 figs., 1942.

A fungus, tentatively identified as *Ptychogaster cubensis* on the basis of comparison with numerous herbarium specimens, was isolated from decaying heartwood in *Quercus phellos*, *Q. nigra*, and *Q. catesbaei* and from central decay in living stems of waxmyrtle (*Myrica cerifera*), the first-named from Louisiana and the others from Florida. The conidial stage of the fungus was collected on dead trunks of *Q. catesbaei*, *Q. nigra*, and *M. cerifera*, and at branch stubs and injuries on living trunks of *M. cerifera* and *Q. virginiana geminata*. The herbarium specimens examined were from Brazil, Peru, Hawaii, India, Haiti, and the Bahamas, but until comparison of cultures from various hosts in the above localities are made, it will remain doubtful whether they represent one or several species. Those from Peru and the Bahamas contained what appeared to be a few basidiospores, indicating that the *P. cubensis* type of fungus has a basidial stage in the genus *Polyporus*.

Attempts to germinate conidia of *Ptychogaster cubensis* in culture were unsuccessful. The fungus grew well at 30° C., but was inhibited at 10° and 40°. On 2 per cent. malt agar, mats 2·5 to 5 cm. in diameter were formed after 14 days at room temperature; at first they were white, moderately raised, and loose cottony, but later became darker at the centre with a narrow or wide, white margin. When illumination was weak the cultures remained almost white. Setal hyphae were formed in abundance, visible to the naked eye as fine brown streaks. Staining hyphae were thin-walled, 1 to 5 μ in diameter, with cross walls but without clamps; non-staining, yellowish ones were found in the brown portions of the mats in connexion with conidial formation. Conidia were abundant, often formed in chains, globose, ovoid or irregular, and measuring 5 to 10 μ in diameter.

Davidson (R. W.), Campbell (W. A.), & Vaughn (Dorothy B.). **Fungi causing decay of living Oaks in the eastern United States and their cultural identification.** *Tech. Bull. U.S. Dep. Agric.* 785, 65 pp., 3 pl., 4 figs., 1 diag., 1942.

The authors secured many isolates of oak heart-rotting fungi from various localities in the central, eastern, and southern States of the American Union and identified all the more important organisms by their cultural characters [cf. *R.A.M.*, xvii, p. 423; xviii, p. 360], in which connexion an account is given of the classification and file

system developed by the Division of Forest Pathology for purposes of reference and comparison. The first column of the index cards used for the transcription of the pertinent data is concerned with such obvious cultural aspects of a given fungus (*Polyporus hispidus* [ibid., xvii, p. 83] being cited as an example and the card describing it figured) as colour of the mycelial mat and growth rate on malt agar, while the oxidase reaction is included for the separation of white from brown rot fungi. At the top of the second column are listed such features as the texture of the mat and type of margin, the variability of which, however, precludes their use in the formulation of the key pattern. The lower part of the second and the whole of the third column are reserved for notes on the microscopic characters of the fungus, the more important being sketched in the space provided in columns four and five, which also contain information as to the origin of the culture and test-tube data, taken preferably at 28 days. A line is left at the bottom of the card for remarks on distinguishing characteristics—colour and the presence of setal hyphae in the case of *P. hispidus*—while a Petri dish photograph of the fungus taken at 14 days is pasted on the back. The file pattern at the top of the card expresses the macroscopic and microscopic features of the pathogen, the former being represented by letters and the latter by numbers, with the following formula for *P. hispidus*: C (yellow) —P (positive for oxidase—white rot)—M (medium growth rate, 5 to 9 cm. in 14 days at 26° C.)—7 (setae)—11 (non-staining hyphae). Based on this system, a key has been drawn up for the 50 oak-rotting fungi investigated along these lines.

In the eastern States, *Stereum gausapatum* was the predominant agent of butt rot in young stands [ibid., xiv, p. 663], parent stumps providing the main source of infection, while other species often encountered were *Armillaria mellea*, *Fistulina hepatica* [ibid., xvii, p. 277], and *S. frustulosum* [ibid., xix, p. 246]. The last-named and *Hydnum erinaceus* [loc. cit.] apparently enter the trees of older stands in the central and eastern States through fire wounds in the base or upper part of the trunk or large branches near the top. Other important trunk- or top-inhabiting species in the central States were *Poria andersonii* [ibid., xix, p. 374] and *Polyporus dryophilus* [ibid., ix, p. 749], while *P. compactus* [ibid., xvi, p. 505], *P. sulphureus*, and *Poria cocos* [ibid., viii, p. 813; xix, p. 246] were also commonly isolated in these areas and the east. In the Mississippi Delta region oak heart rots were mostly caused by species absent from the other localities comprised in the survey, young fire-wounded stands being invaded by *Fomes geotropus* [ibid., xv, pp. 471, 759], *Lentinus tigrinus* [ibid., xviii, p. 559], *Corticium lividum* [ibid., xix, p. 246], and *Polyporus lucidus* [*Ganoderma lucidum*], the last-named, with *F. geotropus*, being the predominant species among older fire-damaged trees, which also harboured *P. zonalis* [loc. cit.], *P. fissilis*, *P. ludovicianus*, and *Poria inflata*. Of the 1,718 classified oak decay infections procured from all the areas sampled, 707 were caused by *S. gausapatum*, 135 by *H. erinaceus*, 96 by *A. mellea*, 71 by *Fistulina hepatica*, 66 by *P. andersonii*, 55 by *Polyporus compactus*, 51 by *P. dryophilus*, 45 by *Poria cocos*, 42 by *Polyporus sulphureus*, 29 by *Fomes geotropus*, 27 by *C. lividum*, 27 by *P. spraguei* [ibid., xvi, p. 716], and 22 by *G. lucidum*, while each of the 34 rarer species accounted for one or more infections (up to 17): *F. everhartii* [ibid., xviii, p. 487], *F. applanatus* [*G. applanatum*], *F. robustus* [ibid., xvii, p. 358], and *P. hispidus*, commonly found forming fruit bodies on living oaks, were only isolated from seven, four, three, and six, respectively, of the samples examined.

Many of the heartwood specimens yielded only moulds or other non-rotting fungi, e.g., *Paecilomyces varioti* [*Penicillium divaricatum*: ibid., xix, p. 317], which was commonly isolated from brownish streaks widely removed from trunk or basal openings and from brown discolorations round insect tunnels; *Trichoderma lignorum* [*T. viride*: ibid., xvi, p. 575]; and the imperfect stage of (?) *Coryne sarcoides*, characterized by dark reddish-purple coremia bearing conidia in profusion.

Considerable damage was inflicted on the trees by the more prevalent wood-rotting fungi, but in general, the information on this point is not sufficiently accurate or

extensive to form a basis for further discussion. There was no marked tendency to preference for any particular host on the part of most of the fungi under observation, but *Fistulina hepatica* was usually obtained from scarlet oak [*Quercus coccinea*] and *Corticium lividum* almost exclusively from the overcup oak (*Q. lyrata*).

Smith (M. E.) & Bayliss (N. S.). **The necessity of zinc for Pinus radiata.**—*Plant Physiol.*, xvii, 2, pp. 303–310, 3 figs., 1942.

Seedlings of *Pinus radiata* grown at the University of Western Australia in nutrient solutions deprived of zinc by extraction with a chloroform solution of diphenylthiocarbazone (a method likewise applicable to the removal of copper) developed in the course of three or four months deficiency symptoms comprising a retarded growth rate with consequent flattening of the tops; inward folding of the apical needles, which later exhibit a yellow mottling, followed by bronzing; the production of short, stiff, dark green secondary needles in unopened fascicles; and swelling of the root tips. Attempts to induce mycorrhizal formation on the roots of the experimental plants were unsuccessful [cf. *R.A.M.*, xvi, p. 9], so that the role of these structures in relation to zinc deficiency, a common cause of disease in pines according to studies by S. L. Kessel and T. N. Stoate (*Aust. For.*, i, pp. 4–13, 1936; *Bull. W. Aust. For. Dep.* 50, 1938), could not be further investigated.

Baxter (D. V.). **Some resupinate Polypores from the region of the Great Lakes. XIII.**—*Pap. Mich. Acad. Sci.*, xxvii (*1941*), Part I, pp. 139–161, 11 pl., 4 maps, 1942.

Continuing his studies on the resupinate Polypores from the Great Lakes region of the United States [*R.A.M.*, xx, p. 388], the writer draws attention to the importance of *Trametes serialis* as an agent of decay in Sitka spruce (*Picea sitchensis*), a valuable source of timber for aeroplane construction, and other softwoods [ibid., xiv, p. 805; xx, p. 2; xxi, p. 110]. Specimens of the fungus have been collected from both the coastal and interior forests of Alaska, the Yukon Territory, and the Northwest Territories, as well as from other parts of Canada and a number of States of the American Union.

T. serialis may be differentiated from the related *T. heteromorpha* by its brown pileus, that of the latter being white, and smaller pore mouths, averaging 2 to 3, occasionally 4, to a mm. compared with 0·5 to 3 in *T. heteromorpha*. *T. morganii* on poplar and oak has repeatedly been mistaken for *T. serialis*, but in all probability most of the specimens labelled by the latter name on hardwoods are actually referable to the former, though birch (*Betula papyrifera*) is one of the hosts of the latter. A certain macroscopic similarity exists between resupinate specimens of *Fomes fraxinophilus* [ibid., xviii, p. 280] and those of *T. serialis*, but not only is the former confined to ash or buffalo berry [*Shepherdia argentea*], but its bracket shaped or knob-like immature fructifications are usually found elsewhere on the tree, and, moreover, its ovoid spores measure only 6 to 7 by 5 to 6 μ compared with 6 to 10 (usually 7 to 9) by 2 to 3 μ for those of *T. serialis*. Confusion is also very liable to arise between *F. annosus* and *T. serialis* owing to their external resemblances and common hosts, but the ovoid spores of the former measure only 4 to 6 by 3 to 4 μ.

Few lignicolous fungi are of such importance as agents of decay in both standing trees, notably redwood (*Sequoia sempervirens*) in California, and structural timber as *T. serialis*, the immense losses caused by *Lenzites sepiaria* and *Poria incrassata*, for instance, being restricted to felled wood. Decay in storage yards in the Northwest is also largely attributable to *T. serialis*, the ravages of which in shipments of timber become apparent at the place of destination. The fungus commonly gains ingress to standing redwoods through fire scars or 'goose pens', on the walls of which its fruit bodies may often be found; the cubical rotted sections of the invaded trunk in turn become highly inflammable and extensive cavities are burnt in them by subsequent

ground fires. The practice of burning a logged-over area to clear it of the debris incidental to felling and other operations is thus seen to be undesirable. Most of the rot appears to be concentrated in the first 20 ft. of the trunk, though infection may extend up to 36 ft. from the ground.

A diagnosis is given of *T. alaskana* n. sp., occurring in Yukon Territory, Alaska, British Columbia, northern California, Oregon, and Washington on *P. sitchensis*, *P. glauca*, and *Tsuga heterophylla*, accompanied by a discussion on its morphological and cultural characters with special reference to its separation from the allied species, *Trametes serialis*, *T. heteromorpha*, and *T. variiformis*. *T. alaskana* differs from *T. serialis* in its thick habit of growth, its discoloration on drying, and, in culture, its slower, thinner, and smoother growth with longer tubes.

Haddow (W. R.) & Newman (F. S.). **A disease of the Scots Pine (Pinus sylvestris L.) caused by the fungus Diplodia pinea Kickx associated with the Pine spittle-bug (Aphrophora parallela Say.). I. Symptoms and etiology.**—*Trans. roy. Canad. Inst.*, xxiv, 1, pp. 1–17, 1 pl., 1942.

In southern Ontario, *Diplodia pinea* [*R.A.M.*, xx, p. 340; xxi, p. 100] is endemic and ordinarily rare enough to be of little significance, but is capable of causing an epidemic tip blight of Scots pine planting stock in transplant lines, though this trouble, resulting from infection at or near the terminal bud cluster through unknown courts, has never become serious.

During the past few years, however, the fungus, in association with the pine spittle bug (*Aphrophora parallela*) has been responsible for a lethal, epidemic bark disease of the twigs, branches, and stems of Scots pines, characterized by massive crown infection and close spread, and often causing the death of entire trees. Much of the foliage dies without becoming infected, owing to the death of the branches bearing it. The needles turn rusty-brown and are retained until winter, or later. When the current season's shoots are infected early, by spread of the fungus from below, they often become characteristically bent or curled, and usually die before maturing. When these shoots are infected near the distal end, late in the season, there is marked stimulation of budding just below the lesion. The disease is essentially one of the bark of the younger internodes of the branches and trunk. Small, local lesions, originating in stylet wounds, coalesce and become large lesions. When the internodes rapidly increase in diameter, the lesions assume a canker form, and slight surface irregularities develop. Resin exudes copiously from bark fissures and the base of short shoots. It causes conspicuous bluish-white streaks on the bark and sometimes collects in soft masses in the foliage. Short shoots on infected branches are invaded, and the leaves killed.

The development of the disease depends on association with the insect. When this becomes epidemic, the trees are conditioned for mass infection, which in turn leads to rapid increase in inoculum. The nymphs, enveloped in spittle, appear just below the expanding buds about the middle of May. They feed mostly on the shoots on which they are born, and the penetration of the feeding holes is often deep. When adults feed on young internodes, the cambium may be reached. Traumatic false rings are induced in the late wood. The insects thrive on healthy, vigorous trees.

The authors' studies lead them to conclude that *Phoma pinastri* Lév., *Diplodia conigena* Desm., and *Sphaeropsis ellisii* are synonymous with *Diplodia pinea*, which, for reasons of priority, should be retained. The spores ranged from 33 to 46 by 12 to 16 μ. Newly matured pycnidia were found early in June, and throughout the summer, commencing to sporulate when wetted, i.e., in rainy weather, and when the bark was wetted by the dripping spittle.

In inoculation tests, typical crown blight resulted when a concentrated spore suspension of the fungus was applied to a branch infested by the insects, on a tree growing in a locality where the disease had not previously been observed.

Forest Research in India and Burma, 1940–41. Part I. The Forest Research Institute. —161 pp., 1941.

K. D. Bagchee, in this report (pp. 105–107), states that the study of wood-rotting fungi was given precedence over all other investigations. Data on the loss of sal [*Shorea robusta*] sapwood from infection by *Fomes lignosus*, *Polystictus sanguineus* [*R.A.M.*, xvii, p. 88], *Schizophyllum commune*, *Stereum hirsutum* and various Polypores, and by *Lenzites sepiaria* and *P. versicolor* on chir [*Pinus longifolia*] were tabulated for future reference. Ascu [ibid., xix, p. 504] effectively inhibited the growth of *Polystictus sanguineus* on *Shorea robusta* sapwood blocks at concentrations of 4, 6, and 8 per cent.

Narayanamurti (D.) & Ranganathan (V.). **Studies on coal tar creosote as a wood preservative. Part I. Creosote extracted from timbers in service.**—*For. Bull. Dehra Dun*, N.S., 104, Util., 18 pp., 1 diag., 1941 (issued 1942).

A tabulated account is given of recent analyses of creosotes extracted from old hard- and softwood railway sleepers that had been in service for varying periods on Indian railways, and some sal (*Shorea robusta*) fence posts treated and set up at the Forest Research Institute, Dehra Dun [cf. *R.A.M.*, xix, p. 632]. Variations were detected in the composition of the creosotes extracted from different sleepers, and even from different positions of the same sleeper, while the specific gravity of the oil extracted was generally higher in the outer sections, the oil in which also contained higher residues than the inner layers [cf. ibid., xvii, p. 4]. Tar acids were not entirely leached out even after lengthy periods of service, 4 per cent. being present, for instance, in *Schina wallichii* sleepers after 14 years; the average life of this species is estimated at 26 years. Leaching was more extensive at the bottom of a sleeper, whereas the top and outer layers underwent greater evaporation and oxidative changes. In the fence posts the specific gravity of the creosote tended to increase with height, concurrently with a significant drop in the concentration of the fungicide. After 24 years on the track, the *Dipterocarpus macrocarpus* sleepers were still sound, but less satisfactory results were obtained with fir (*Abies pindrow*), especially those treated by the Rueping process, in which penetration was shallow.

Hildebrand (A. A.) & Koch (L. W.). **Savoy disease of Sugar Beets in southwestern Ontario.**—*Phytopathology*, xxxii, 4, pp. 328–331, 1 fig., 1 diag., 1942.

Attention is drawn to the occurrence on sugar beets in southwestern Ontario of the 'savoy' disease previously reported by Coons and his collaborators from the United States, where transmission was effected by the pigweed bug *Piesma cinerea* [*R.A.M.*, xvi, p. 510]. This insect has also been reported from Ontario by Stirrett (*Sci. Agric.*, xvi, pp. 180–196, 1935) and circumstantial evidence points to the conveyance of the virus to the beets from weeds, among which were *Ambrosia artemisiifolia*, (wild) carrot, *Solidago canadensis*, *Chenopodium album*, white clover (*Trifolium repens*), and *Amaranthus* spp. In one of the fields inspected, 245 out of 11,200 plants (2·1 per cent.) were found to be 'savoyed', the maximum incidence of 6·5 per cent. in a single row being registered in those portions nearest to the weeds.

Leach (L. D.) & Davey (A. E.). **Reducing southern Sclerotium rot of Sugar Beets with nitrogenous fertilizers.**—*J. agric. Res.*, lxiv, 1, pp. 1–18, 2 figs., 3 graphs, 1942.

In field experiments conducted from 1934 to 1937 in the Sacramento Valley, California, the application of nitrogenous fertilizers gave a consistent reduction in the percentage infection of sugar beets by *Sclerotium rolfsii* [*R.A.M.*, xx, p. 618]. The average results from 13 trials showed that 50 lb. nitrogen per acre reduced infection by about 28 per cent., 100 lb. by 54 per cent., and 200 lb. by 65 per cent., compared with unfertilized areas. The results were equally good whether ammonium sulphate,

anhydrous ammonia, calcium nitrate, or cyanamide was used (in equivalent amounts) as the source of nitrogen, no significant differences being observed whether the fertilizer was broadcast in advance of planting, dissolved in the irrigation water, or applied as a side dressing to the growing crop. For satisfactory results the applications must be made before any large percentage of beets has been infected. In heavily infested, or in some cases even in lightly or moderately infested fields, the increases in yield are, however, stated to be too insignificant to warrant the application of nitrogenous fertilizers, and the economic use of this method of control is, therefore, limited to fields in which the increase in yield following treatment more than balances its cost.

Laboratory experiments showed that low concentrations of ammonia in aqueous solution are toxic to the mycelium and sclerotia of *S. rolfsii*; ammonium sulphate in alkaline solution was mildly toxic to the mycelium, while calcium nitrate in solutions of similar concentrations was harmless to the mycelium and sclerotia. Since these three materials gave equally good results in field trials, it is suggested that the control obtained may have been due to factors other than ammonium toxicity. Heavy applications of anhydrous ammonia and cyanamide to naturally infested soils failed to destroy the sclerotia or to reduce their viability, but the effects of these materials upon mycelium in the soil were not determined. As an explanation of the partial control obtained in these experiments by nitrogenous fertilizers, it is suggested that changes in the metabolism of the fungus may reduce its growth or pathogenicity; that resistance of the host plants may be increased by changes in its metabolism and anatomy; or that the fungus may be suppressed following a change in the balance of micro-organisms in the soil.

Dahlberg (H. W.), Maxson (A. C.), & Brewbaker (H. E.). **Breeding for resistance to leaf spot and other characters.**—*Proc. Amer. Soc. Sug. Beet Technol., 1940*, pp. 169–180, 1940. [Abs. in *Sugar*, xxxvii, 4, pp. 42–43, 1942.]

Among other objectives of the Great Western Sugar Company are the development of beet varieties resistant to curly top [*R.A.M.*, xxi, p. 316], blight or leaf spot [*Cercospora beticola*: ibid., xxi, p. 178] (which largely determines the choice of varieties in the three States of the American Union and one Canadian Province covered by the Company's operations, i.e., Michigan, Ohio, Indiana, and Ontario), and *Rhizoctonia* [*Corticium solani*: loc. cit.]. In this region the Great Western field variety may be used for 60 per cent. of the beet acreage, a leaf spot-resistant variety for 35 per cent., and a new one resistant to *C. solani* for 3 to 5 per cent. Several lines of approach are followed in breeding for leaf spot resistance, including intensive family and group breeding, mass selection, F_1 crosses, crosses of élite material with *B*[*eta*] *maritima* (North Sea types), and selection in self-fertilized lines. Some of the new strains combine resistance to leaf spot with winter-hardiness, and a gain of about 1·5 points in purity over foreign varieties has been accomplished.

Reinau (E. H.) & Macke (W.). **Wann ist Schwefel ein Vorbeugungsmittel gegen Herzfäule der Zuckerrübe?** [When is sulphur a prophylactic against heart rot of the Sugar Beet?]—*Angew. Bot.*, xxiii, 5, pp. 348–360, 1941.

The writers fully describe their laboratory and field trials at the Research Station for Soil Hygiene at Strassburg, Alsace, supplemented by experiments on a local farm, the results of which showed that the development of heart rot of sugar beets in over-limed and strongly alkaline soils may be counteracted by the application of sulphur in sufficient quantities to adjust the reaction to neutrality. In 1932, the percentages of healthy beets in plots supplied the previous year with 800 and 1,600 kg. per ha., respectively, were 90 and 97, respectively, compared with 80·76 for the untreated control plots and 94·05, 95·7, 98·6, 99·1, and 99·6 for those receiving 3, 5, 10, 20, and 40 kg. boric acid per ha., respectively, the results from the 1,600 kg. application being

thus intermediate between the 5 and 10 kg. boric acid treatments [*R.A.M.*, xviii, p. 428]. The constitution of the soil once having been improved by the judicious incorporation of small doses of sulphur, say 300 to 800 kg. per ha., it should be possible to maintain the boron balance by the reintroduction into the ground of the quantity of boric acid withdrawn by a sugar beet crop, i.e., 2 to 2·5 kg.

Roque (A.) & Adsuar (J.). **Studies on the mosaic of Peppers (Capsicum frutescens) in Puerto Rico.**—*J. Agric. P.R.*, xxv, 4, pp. 40–50, 4 figs., 1941.

Three years prior to the time of writing, a mosaic disease of [chilli] pepper (*Capsicum frutescens*) developed in epidemic form at the Agricultural Experiment Substation, Isabela, since when it has spread with great intensity to other parts of Puerto Rico [*R.A.M.*, xx, p. 564]. Serrano and Riollano (*in litt.*) estimated the crop losses due to the disease at Isabela in 1938 at 50 to 60 per cent. Symptoms of infection include a marked clearing of the veins in the younger leaves in about 10 to 12 days after inoculation, followed by systemic mottling, usually ending in veinbanding. In addition the leaves become wrinkled and the plant stunted, especially if infected early. Fruit-setting is reduced and the fruits that develop are undersized, mottled, and badly distorted. On the Large Bell Hot variety a systemic vein necrosis is produced in five or six days and is followed by defoliation, stem-streaking, and death, whilst mottling and veinbanding are absent.

The virus responsible for the disease is readily transmissible by mechanical methods and evidence was secured that the aphid *Myzus persicae* is also concerned in its conveyance from infected to healthy plants. It is inactivated by 48 hours' ageing *in vitro* and by exposure to a temperature of 55° to 58° C., while infectivity rapidly declines at dilutions of 1 in 80 and is virtually nil at 1 in 100. No immunological relationship could be established, by inoculation experiments on the Large Bell Hot variety, between the Puerto Rican chilli mosaic, the potato mottle and veinbanding viruses, or those of ordinary tobacco mosaic and cucumber mosaic.

Of 84 chilli varieties tested, only two showed any resistance to the virus. Inoculation experiments on Virginia tobacco, *Nicotiana glutinosa*, *N. bigelowii* vars. *multivalvis* and *quadrivalvis*, and *N. rustica* gave positive results. Occasional symptoms further developed on the Puerto Rican Beauty eggplant and the Marglobe tomato, but the presence of the virus was not substantiated by tests back to Large Bell Hot chilli.

The results of these studies appear to indicate that the virus under discussion is either a known form not hitherto reported as attacking chilli, or an as yet undescribed entity.

Kligman (A. M.). **Secondary spores in the mycelium of the cultivated Mushroom, Psalliota campestris Fr.**—*Amer. J. Bot.*, xxix, 4, pp. 304–308, 9 figs., 1942.

Chlamydospore-like bodies were consistently observed in old cultures of the brown and white varieties of the cultivated mushroom, *Psalliota campestris*. None were found in young cultures of the cultivated varieties or in any cultures of the wild, four-spored mushroom. The chlamydospores (the term is here used for transformed vegetative cells capable of giving rise to new mycelia) studied in old cultures of fertile races of the 'snow-white' variety, [R.A.M., xx. p. 621] are described as being rarely less than 8 μ in diameter or more than 25 μ in length (average 10 by 14 μ), septate, ovoid, globose, rectangular, or elliptical, with many modifications of these shapes, and as a result of random septation, either terminal, intercalary, or most frequently in chains. Their cytoplasm is dense and loaded with granules; they are most abundant at and just below the surface of the agar. The chlamydospores formed by the sterile races of *P. campestris*, on the other hand, were rounder and more uniform in shape; their cytoplasm was not dense and contained no granules. In both the fertile and the sterile races, chlamydospores were found to be multinucleate. The twelve single-spore

isolations obtained from a fertile race presented no cytological or morphological differences, and mushrooms were grown from each of the cultures made from these spores.

Woodroof (Naomi C.). **Increased yields of Spanish Peanuts obtained by dusting.**—*Circ. Ga Exp. Sta.* 136, 4 pp., 1 fig., 1942.

The average increase per acre in the yields of Spanish groundnuts obtained at four localities in Georgia in 1941 by dusting for leaf spot [*Cercospora arachidicola* and *C. personata*] control [*R.A.M.*, xviii, p. 236; xxi, p. 126] with sulphur, copper-sulphur 10–90, copper-sulphur-clay 10–30–60, copper-wheat flour-clay 10–10–80 (the copper used being basic copper sulphate in each instance), and red copper oxide-clay 10–90 were 400·6, 463·6, 423·2, 254·2, and 444·1 lb., respectively. The average increase secured with sulphur dust over the five-year period 1937 to 1941 amounted to 326·4 lb. per acre. In 1941 two broadcast applications of a sulphur-gypsum mixture 1–3 resulted in an increase of 222·9 lb. per acre. It is recommended that dusting with sulphur (93 per cent. through a 325-mesh) or copper-sulphur 10–90 should be begun on the first appearance of the spots on the basal leaves (usually 60 to 65 days after planting or between 15th June and 1st July), three to four applications being given, ordinarily at fortnightly intervals, and 15 to 20 lb. per acre used. The cost of the sulphur used amounts to $3·00 to $3·50 per 100 lb.

Nedeltscheff (N.) & Kondareff (M.). **Beobachtungen über die Behandlung von Weinreben gegen Peronospora. Bei der Behandlung von Weinreben mit Kupferlösungen auftretende Verbrennungen.** [Observations on the treatment of Vines against *Peronospora*. Scorching consequent on the treatment of Vines with copper solutions.]—*Annu. Univ. Sofia*, xviii, 1, pp. 51–80, 181–192, 1940. [Abs. in *Chem. Zbl.*, cxiii (i), 15, p. 1930, 1942.]

In comparative trials on the control of vine *Peronospora* [*Plasmopara viticola*] in Bulgaria with copper sulphate solutions of varying strengths from 0·2 to 2 per cent. and Casale's 0·2 per cent. colloid solution [*R.A.M.*, xvii, p. 12], the minimum toxic concentration for the standard preparation was 0·75 per cent. (a 1 per cent. solution is recommended for practical purposes) and no advantage was derived from the use of the colloid solution, since its lack of scorching tendency was outweighed by its poor fungicidal properties. The extent of the scorching caused by the standard solutions seemed to be virtually independent of their concentration, the lower dosages, in fact, often producing more severe injury than the higher ones, especially at an acid reaction, little damage occurring around P_H 9·0, while the trouble was further mitigated by the addition to the mixture of linseed oil or resin.

Benlloch (M.). **Algunas características fitopatológicas del año 1941.** [Some phytopathological characteristics of the year 1941.]—*Bol. Pat. veg. Ent. agric., Madr.*, x, 29–32, pp. 1–14, 10 figs., 1941.

In contrast to the severity of the vine [downy] mildew [*Plasmopara viticola*] epidemic of 1940, the Mancha and the greater part of central Spain remained free from the disease in 1941, notwithstanding the rainy spring, the favourable effect of which on the pathogen was apparently counterbalanced by the adverse factors of wind, low temperature, and reduced vegetative activity of the host during May. In other viticultural centres with a more temperate climate infection became established at an early date and the damage was aggravated by the prevailing scarcity of available copper for spraying. In this connexion reference is made to recent experiments in Spain in the treatment of downy mildew by the Italian low-copper formulae [R.A.M., xx, p. 622; and preceding abstract] the action of which, however, cannot be altogether relied upon in a virulent epidemic. A saving in the copper consumption could no doubt be effected by the use of spreaders and stricter observance of the critical dates for the

application of the treatments. For the study of the 'masked' form of downy mildew on bunches of grapes described in *Agricultura, Madr.*, No. 101, 1940, a useful procedure consists in boiling the samples for investigation in a 5 per cent. potash solution and staining them in lactic blue, which throws the mycelium into sharp relief.

Andalusia was the only part of the country in which olives were attacked by *Gloeosporium olivarum* [*R.A.M.*, xxi, p. 243], but there the damage was considerable, especially in the late varieties, the development of the pathogen being favoured by the wet autumn and winter. Olive leaves from Lucena (Cordova) attacked by *Cycloconium oleaginum* [ibid., xx, p. 504] bore white lesions quite unlike those normally associated with this fungus, their presence being due, according to [L.] Petri, to the interposition of a stratum of air between the cuticle and the epidermis in the infected portions of the foliage. *Phoma fallens*, the agent of a so-called 'rain stain' of olive fruits in Saragossa, is suspected of causing a similar disorder of the same host in Cordova and Seville, but the absence of fructifications in the latter regions prevented the final determination of the pathogen. The lesions produced by *P. fallens* are much smaller than those due to *Macrophoma dalmatica* [ibid., xviii, p. 10], the common agent of 'rain stain', measuring barely 2 mm. in diameter as compared with 5 or 6 mm., and penetrating much less deeply into the fruit.

Weather conditions during the period under review were conducive to an intensive outbreak of chickpea [*Cicer arietinum*] blight (*Phyllosticta* [*Ascochyta*] *rabiei*) in the Andalusian provinces, where the crop in many cases was a total loss. In the province of Burgos, where vegetation was retarded by the cold, and spring sowing impeded by heavy rains, heavy losses were likewise observed.

Pear leaves from Aranjuez (Madrid) bore severe lesions characteristic of *Septoria piricola* [*Mycosphaerella sentina*: ibid., xix, pp. 134, 582], the pycnidia obtained from which, however, corresponded with those of *P. pirina* [*Phoma prunicola*: ibid., xvi, p. 106], reported as pathogenic to the same host in Italy but not hitherto observed on pears in Spain.

The abnormally heavy rainfall in 1941 favoured the luxuriant development of rye ergot (*Claviceps purpurea*), up to 12 sclerotia of which were counted in a single ear at Burgos. The disease, ordinarily confined to the humid regions of the north, spread to the central regions, including Madrid, where the damage, however, was negligible.

Memoria de los trabajos realizados por la Estación de Fitopatología agrícola de la Coruña. Anos 1939 40. [Report of the work carried out by the Station of Agricultural Phytopathology of La Coruña in 1939 40.]—*Publ. Estac. Fitopat. agric. Coruña* 14, 35 pp., 1 map, 1941.

In the section of this report dealing with the work of the cryptogamic laboratory of the Corunna Station of Agricultural Phytopathology in 1939–40, J. R. Sardiña states that three walnut trees, two of 20 years old and the third younger, at Campolongo (Puentedeume), bore excrescences ranging from 2 cm. in diam. to 25 by 18 cm. scattered over all the branches. *Bacterium tumefaciens* being suspected as the causal organism, attempts were made to isolate it but without success.

J. R. Sardiña and P. Urquijo Landaluze give an account of a species of *Empusa* parasitic on the aphids *Aphis gossypii*, *A. laburni*, and *Capitophorus* (?) *whitei* on saltwort [*Salsola*], bean [*Phaseolus vulgaris*], and chilli plots at the Experiment Station. Its branched, claviform conidiophores, 96·9 to 110·5 by 8·5 to 11·1 μ, bore subspherical primary conidia, with a truncate base and mucronate apex, 9·3 to 11·9 by 10·2 to 14·5 μ, and hyaline spores, shaped like grape pips, 21 to 30 by 10 to 11·5 μ. Affected aphids assume a chestnut to olive tinge. Inoculation experiments in the laboratory gave inconclusive results.

Soil acidity is believed by P. Urquijo Landaluze to be the primary cause of a rye disease involving such weakness of the ears that they slip from the sheath and bend over in the form of a crook; no grain is formed, with the result that the crop is a total

loss. The trouble occurs only over a limited area in the hilly district of Aranga, where the hydrogen-ion concentration of the soil is P_H 5·4. All the affected plants revealed the presence of *Scolecotrichum graminis* (a new record for Galicia), which may have acted as a secondary cause of the disease. The correction of the acid condition of the soil by the application of lime at the rate of 100 kg. per 'ferrado' [12 sq. yds.] is recommended.

Good control of rye mildew (*Erysiphe graminis*), another new record for the province, was secured by dusting with sulphur, and spraying with a 1 per cent. suspension of sulphur in 3 per cent. soapy water or with 0·5 per cent. lime-sulphur.

'Blanching' of chilli, originally observed in Valencia [*R.A.M.*, xx, p. 225], was found to be also affecting the local crops, and investigations on the disease were pursued by J. R. Sardiña. Inoculation experiments with eight-months-old juice from infected plants were successful on chilli, two tobacco varieties (Cantabria and Tall Valencia), and *Nicotiana rustica* var. *erbasanta* to the extent of 50, 100, and 100 per cent., respectively, indicating that the virulence of the infective principle is maintained *in vitro* for the period named. The symptoms induced by the 'blanching' virus on tobacco closely resemble those of ordinary mosaic or tobacco virus 1, but it is considered probable that a virus complex is involved in the case of the chilli disease, since tobacco virus 1 does not induce the malformation of the fruits associated with blanching. Chilli plants inoculated with the juice of tobacco plants artificially infected by blanching developed no mottling but slight rugosity of the young leaves, thereby affording further proof of the complex nature of the virus.

Among the fungi isolated by J. R. Sardiña from a chestnut canker was an undetermined species of *Cytospora*, which may possibly prove to be the imperfect stage of *Endothia parasitica*. Inoculation experiments gave negative results.

Full particulars are given of a cultural and morphological study by P. Urquijo Landaluze on *Phytophthora cambivora*, the agent of ink disease of chestnut [see below, p. 434], 121 isolates of which were grown on various solid and liquid media; among the former, carrot slices and Leonian's malt extract agar afforded the most luxuriant development, while of the latter a synthetic medium containing 10 gm. asparagin was particularly favourable. A prominent feature of the cultures was the presence of 'reserve organs' of highly variable forms, ranging from rounded or spiniform hyphal enlargements to terminal extensions presenting divers irregularities, or assuming a uniformly spherical growth habit and simulating oospores, with an average diameter of 20 to 30 μ. Further investigations are necessary to determine the exact nature of these organs, which may represent 'parthenogenetic oospores' to use Allain's term [ibid., xiii, p. 65] or chlamydospores. The results of isolation experiments on withered three- and seven-year-old chestnut trees confirmed the fact that the mycelium of *P. cambivora* penetrates the cambial zone of the stem in a tangential direction but does not enter the root until the onset of secondary decay by bacteria and saprophytes. Up to 100 per cent. of the isolation tests were successful, the incidence of positive results declining with the advancing age of the host; these observations are in sharp contrast to those of Petri in Italy and Milburn and Gravatt in the United States [ibid., xii, p. 337], who experienced great difficulty in the isolation of the pathogen from naturally diseased trees. Experiments are in progress on the control of the fungus by the application to the stem bases of copper oxychloride or copper carbonate.

Among other fungi new to Galicia, besides those already mentioned, were *Ophiobolus graminis* on wheat, *Macrosporium* [*Stemphylium*] *sarciniforme*, *Phoma destructiva*, and *Cladosporium fulvum* on tomato, *Cercospora beticola* and *Uromyces betae* on beet, *Oidiopsis taurica* on artichoke, and *Colletotrichum gloeosporioides* on orange.

SĂVULESCU (T.). **Rumania. Phytopathological events during the year 1941.**—*Int. Bull. Pl. Prot.*, xxxiii, 2, pp. 17M–19M; 3, 36M–39M, 1942.

In this report on plant diseases in Rumania in 1941 [cf. *R.A.M.*, xvii, p. 655] it is

stated that the diseases most frequently affecting sugar beet locally are *Cercospora beticola* [ibid., xxi, p. 114], mosaic, dry and heart rot [ibid., xxi, p. 266], and *Bacterium tumefaciens* [ibid., xx, p. 154]. On 3rd September, 1941, rust (*Uromyces betae*) [ibid., xx, pp. 292, 333] appeared for the first time at Cenad, Department of Timis Torontal, Banat, badly damaging the crops, especially those given chemical fertilizers. The most susceptible variety was Cesena C.

President Drouard pears growing near Bucarest were affected with bitter pit ('Stippenkrankheit'), first observed in Rumania in 1934, when it was found on apples.

Varieties of *Lupinus angustifolius* and *L. luteus* imported from Germany in 1937-8, have been attacked by wilt, only *Fusarium oxysporum* [ibid., xviii, pp. 116, 832; xx, p. 235] being isolated from infected material. Control is recommended by planting new crops on clean land and seed treatment with germisan, ceresan, or abavit.

Safflower crops near Bucarest were severely infected in July 1941 by *Puccinia carthami* [ibid., xix, p. 116], only the uredospore and teleutospore stages being found.

Up to 1934, the chief fungous disease of sunflowers in Rumania was *Puccinia helianthi* [ibid., xx, p. 596; xxi, p. 242], but in 1933 root and collar rot due to *Sclerotinia libertiana* [*S. sclerotiorum*: ibid., xvii, p. 128] caused serious infection in one locality, and later it appeared in others. During the summers of 1940 and 1941 sunflower heads were also attacked by a rot causing very severe damage, due to the same fungus. Atanasoff reported the disease on a number of important host plants in Bulgaria in 1934, sunflowers being one of the most severely attacked. In Rumania in 1933, the disease first developed on the main roots and collar of the sunflowers. In wet weather, the infected parts appeared as if scalded, and were covered with mycelium; in dry weather they had a dry and wilted aspect. Wherever the disease was present, the plants rotted, many being bent and broken. The losses amounted to 10 to 15 per cent. or more, particularly in wet, low-lying localities. In the autumn of 1940 the flowerhead rot was observed at Băneasa. The attack was very intense, and the affected inflorescences became useless. The principal effect was a softening of the flowerheads from the point of insertion to the edges. At this time the heads bore fruit, but where infection was present, the seeds remained small; most were shrivelled, and the kernels were brownish-yellow. The tissues also became soft at the base of the fruits in the infected part of the thalamus. Numerous sclerotia were found on attacked parts. In 1941, this flowerhead rot was present almost everywhere, in some localities, e.g., Northern Moldavia, causing 70 per cent. damage. Humidity appears to play an important part in the development of the disease. In laboratory tests, the optimum temperature for the development of the fungus varied between 17° and 20° C. In an experimental field in which three strains of sunflower were cultivated, one with black, one with spotted, and a third with white seed, the white-seeded strain was the most susceptible. Affected plants should be uprooted and burnt. Sunflowers should not be grown in low-lying, humid regions, and once an attack has occurred should not be grown in the same field for some years. Rotation and deep ploughing are also advised. Fertilizer applications appear to have no influence on the condition.

Leaves of *Caragana arborescens* showed spots due to *Septoria caraganae*, reported previously only in Germany.

Fifteenth Annual Report of the Commonwealth Council for Scientific and Industrial Research for the year ended 30th June 1941.—107 pp., 1941.

This report [cf. *R.A.M.*, xx, p. 339] contains, *inter alia*, the following items of interest. Detailed studies on a 9-acre wheat plot, where take-all (*Ophiobolus graminis*) [loc. cit.] again developed severely, though not in the same patches as in the previous year, showed that seedling blight was common. The condition also occurred in patches, and there was a correlation between the positions of the affected seedlings and the subsequent development of take-all at heading time. Root amputations showed that

during the exceptionally dry growing season of 1940 the plants depended chiefly on their seminal root systems for moisture throughout the growing period. This partly explains the unusually severe injury caused by early infection of the sub-crown internode or seminal roots with *O. graminis* in the same field. From the seedling stage to early maturity the dominant organism found in wheat roots in the same field was *O. graminis*, but later on species of *Fusarium*, *Helminthosporium*, and *Alternaria* were more common.

Highly significant differences were obtained between wheat crops in drums of soil inoculated the year before with *O. graminis* and crops in uninoculated control drums. The latter were badly affected, the former not at all. Apparently, the difference was associated with greater loss of soil nutrients to the heavy crops in the uninoculated drums during the previous year. This point is to be further investigated.

Apple internal cork [ibid., xx, p. 340] has now become uncommon in Tasmania. The effects of an application of borax at the rate of ½ to 1 lb. per tree were found to continue for at least five years.

Injection experiments to test all likely deficiencies failed to indicate any cause or cure of apple dimple [ibid., xvi, p. 471], and grafting experiments are now in progress.

Investigations on apple storage disorders have shown that the average size of the fruit per tree is related to the percentage disorder and chemical and physical properties of the fruit. The results form a basis for recommendations for the best average size for several varieties.

Six years' tests showed that delay in placing Cox's Orange Pippin apples in cool storage is uneconomic. With Jonathan, incidence of breakdown was greatest with immediate storage, of deep scald after one week's delay, and of Jonathan spot after two weeks' delay; on the whole, immediate storage was the most advantageous procedure [ibid., xxi, p. 374]. With Cleopatra apples storage may be delayed, provided shrivelling and yellowing are controlled.

To brown heart [ibid., xix, p. 545] Sturmer apples are very susceptible, while French Crab, Scarlet, Cleopatra, Tasman's Pride, Cox, and others are less so, and Jonathan, Granny Smith, Democrat, and Crofton resistant. Susceptibility varies from season to season with the same trees, and variation in degree of susceptibility has been observed in Sturmer grown in different soils. Susceptibility is more marked in light than in heavy crops, and increases with degree of maturity at picking. The longer the fruit is exposed to carbon dioxide during storage the lower the concentration must be to ensure freedom from brown heart. During 1937, the maximum safe concentration for Sturmer apples picked in May was about 3 per cent. for a storage period of eight weeks, and 10 per cent. for seven days, and these may be regarded as desirable storage limits for ships. Relatively early in the season, storage temperatures of 32° to 34° F. are more dangerous with a given concentration of carbon dioxide than temperatures of 38° to 40°. Later on, when susceptibility is greater because of delayed picking or cooling, higher temperatures become dangerous, and the highest (50° to 60°) seems to cause the most injury. Concentrations too low to produce brown heart may rapidly stimulate low temperature breakdown in susceptible varieties. Brown heart symptoms do not develop directly the fruit is injured. In fruit stored only two or three weeks, brown heart does not become apparent until about 48 hours after removal from storage.

In fruit storage studies, Jonathan apples kept in gas storage at 40° F. were still sound in January, though comparable fruit kept in air at 32° to 37° showed 10 per cent. wastage by July. 'Delicious' apples were more satisfactory at 32° than 34°, the higher temperature causing greater wastage from mould and breakdown. Gas storage at 32° greatly reduced mould wastage in this variety, but caused greater wastage from superficial scald. With the later pickings of Granny Smith apples, storage at 32° gave better control of mould and late scald than storage at 34°, but with the earlier pickings

there was more superficial scald at the lower temperature. At 40° Granny Smith apples kept much better in gas than in air storage.

A survey of the mould wastage in cold-stored apples from the 1940 crop in New South Wales showed that it was substantially higher in all varieties harvested at Batlow than in those from Orange. In all varieties in both areas it increased as the picking time was delayed. The most important agents of wastage were *Penicillium* sp. (probably *P. expansum*), *Gloeosporium* sp., and *Botrytis* sp. (probably *B. cinerea*).

In field and greenhouse tests, a potato condition known in New South Wales for some years as spindle tuber [ibid., xx, p. 340], and the effects of which on tuber shape resemble those of true spindle tuber, was not transmitted from affected to healthy plants, though true spindle tuber is readily transmissible.

Applications of fungicidal dusts to maize seed against *Diplodia zeae* had no adverse effect on germination or vigour of early growth except when inferior or diseased seed was used. The percentage of *Diplodia*-rotted ears in maize crops at Maffra and Lindenow varied with the moisture content of the soil during the growing period and the previous cropping of the land. There was considerably more ear rot on dry ridges and old maize land than in moister depressions or maize following pasture.

In plots of pine trees [*Pinus* spp.] to which superphosphate was applied at the rate of 1½ cwt. or more per acre, with or without borax, the average diameter of the trunk at breast height increased by about 10 per cent., while in untreated plots or those treated with borax alone the figure was about 7·5 per cent. The phosphate-treated plots also showed a much higher percentage of recovery from needle fusion [ibid., xxi, p. 312], though in some the treatment had little or no effect, possibly owing to insufficient rainfall. Water-culture experiments demonstrated that boron is essential to the normal growth of *P. radiata* and *P. taeda* seedlings.

In experiments with soils of the prune orchards at McLaren Flat, near Adelaide, where a disease is present that resembles little leaf, pot tests were made with the object of diagnosing the cause of disease by growing annuals under different fertilizer treatments. Plants were then selected which exhibited well-marked symptoms when certain elements were withheld. This method gives more reliable information than chemical analysis of soils. It was demonstrated that the light soil at McLaren Flat lacks boron and manganese.

In wood preservation investigations both open-tank and pressure treatment of messmate (*Eucalyptus obliqua*) poles with coal tar creosote gave outstandingly good results, while superficial treatments, i.e., brushing with creosote over sapwood, charring, and the use of arsenic and arsenic and sodium fluoride collars were all unsatisfactory [ibid., xv, pp. 132, 332]. The best of the superficial treatments was oxyacetylene charring plus creosote spraying. After four to five years' exposure the only treatments of various pole species that failed were those with zinc chloride and arsenic and those with chemical bandages. The most toxic fraction of Australian vertical retort oils to three different wood-destroying fungi was that distilling at between 225° and 275° C.

The best control of mould wastage in stored grapes [cf. ibid., xix, p. 458; xx, p. 287] was given by placing a tablet containing 15 per cent. of sodium bisulphite and 4 per cent. of spermaceti with each bunch in the paper woodwool pack, or by treating the granulated packing cork with about 2·5 gm. iodine per lb. of cork. Both treatments almost doubled the period required for an appreciable development of mould at 32°. Treating the cork with the sodium salt of orthophenylphenol also delayed infection.

Annual Report on the Department of Agriculture, Zanzibar Protectorate, 1941.—4 pp., 1941.

In the section of this report [cf. *R.A.M.*, xx, p. 342] dealing with sudden death of cloves in Zanzibar it is stated that where regeneration can be undertaken before the

trees succumb, a sure and simple method is to plant seedlings midway between the old trees. A large block was so replanted early in 1937, and by 1940 all the older trees had died, and the seedlings were sufficiently tall and vigorous to allow the dead trees to be removed, leaving an excellent block of young cloves, which are now bearing. In another experiment begun in 1934, young cloves were planted between lines of still healthy trees, and the canopy of the latter was gradually reduced each year. Costing accounts show very little difference between the profit from this block and that from a control block, not interplanted and not lopped. Sudden death is widespread in the control block, but the experimental area now consists of a healthy block of young saplings, which, though temporarily rather etiolated, have been established at a very small cost.

Where clear felling has already been carried out, artificial shade has proved beneficial. The most successful plant so far found for this purpose is *Gliricidia maculata*; a large block of cloves under this shade suffered during the first years about only half the loss of comparable blocks without this shade. A new establishment trial started in 1941 includes the use of temporary shade by (1) *Gliricidia*, (2) bananas, (3) sugarcane, (4) cassava, and (5) *Gliricidia* and *Calopogonium*. The cloves were planted in April, 1942, when these crops had become established. The merit of *Calopogonium* is that it checks colonization by *Imperata* grass, a weed which interferes with the proper development of the lateral and fibrous roots of cloves.

Manurial tests failed to demonstrate any effect on cloves up to the age of six or seven years. Small trials are being made to ascertain the effect of time of planting on the incidence of sudden death.

Annual Report of the Agricultural Experiment Station, Río Piedras, Puerto Rico, 1940–41.—71 pp., 9 figs., 1941.

This report [cf. *R.A.M.*, xx, p. 563] contains, *inter alia*, the following items of phytopathological interest. L. A. Alvarez states that there are approximately 400,000 acres of coffee in Puerto Rico. The low average yield, amounting to only 200 lb. of dry beans per acre, is partly due to the presence of *Fusarium* root rot [ibid., xx, p. 564], which in some districts is the only limiting factor in production. Pathogenicity studies demonstrated that high temperature and humidity as well as high acidity of the soil favour infection. The virulence of the causal organism remained unaffected after it had been maintained in culture for 1½ years. Varietal tests in the laboratory demonstrated that the Columnaris variety in the seedling stage is as susceptible as the Puerto Rico variety.

Mosaic is a limiting factor in papaw production [ibid., xx, p. 565]. All attempts at transmission have so far failed, but inoculated and control plants, showing no symptoms while in the insectary, become infected when removed to the field and indicate that the disease may be carried by an insect vector.

A study by D. H. Cook and C. F. Asenjo of the papain and protein content of papaws affected with the virus disease complex showed that a diseased fruit yields only about one-tenth as much latex as a healthy one. The amount of active papain in the latex from diseased fruits is somewhat lower than in that of healthy ones (1,051 against 1,351 units as measured by the milk-clotting method per gm. of solids).

N. A. Schappelle states that in some seasons 30 to 40 per cent. of the pineapples grown in Puerto Rico are affected by gummosis [cause unspecified]. Such fruits cannot be exported, as they rot during transit.

A. Roque and J. Adsuar state that crosses and back-crosses have been made between varieties of sweet and pimento [? *Capsicum frutescens*] peppers resistant to mosaic [ibid., xix, p. 254; and above, p. 401] and commercial varieties. Improved types resistant to mosaic have been isolated from second-generation segregates. A variety recently introduced from Mexico has been found to be highly resistant and at the same time excellent for breeding purposes.

JENSEN (H. L.). **Bacterial treatment of non-leguminous seeds as an agricultural practice.**—*Aust. J. Sci.*, iv, 4, pp. 117–120, 1942.

This is a critical review of the recent literature on the bacterization, especially with *Azotobacter* spp., of non-leguminous seeds with a view to the establishment in the soil of a vigorous, free-living, nitrogen-fixing microflora. Of late years this problem, interest in which had largely declined owing to the many disappointments experienced, has been given renewed attention, particularly in the U.S.S.R., where it is considered to be of major agricultural importance both from the scientific and practical points of view [*R.A.M.*, xx, p. 534]. The conclusion reached by the writer is that the beneficial effects of bacterization have not been proved to result from nitrogen fixation by *Azotobacter* or the production of growth compounds by this or other micro-organisms: a more promising line of research would appear to be opened up by the utilization of specific bacterial antagonists for the protection of seedlings against certain plant pathogens susceptible to their destructive action.

MCINTIRE (F. C.), PETERSON (W. H.), & RIKER (A. J.). **A polysaccharide produced by the crown-gall organism.**—*J. biol. Chem.*, cxliii, 2, pp. 491–496, 1942.

In previous studies on the nutrition and carbon metabolism of *Phytomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xvii, p. 18; xxi, pp. 67, 130] a substantial amount of unidentified material was produced by the organism in a synthetic medium. Further investigations on the nature of this substance at the Wisconsin Agricultural Experiment Station have shown it to be a polysaccharide, a full account of which is given.

VOELCKER (O. J.), & WEST (J.). **Swollen shoot and die-back of Cacao.**—*Trop. Agriculture, Trin.*, xix, 5, p. 83, 1942.

The authors now consider that they were mistaken in their earlier view that cacao swollen shoot [*R.A.M.*, xx, p. 517] is only an incident in the general problem of cacao die-back. The results obtained by Posnette [ibid., xx, p. 452] clearly demonstrate that quite apart from the annual die-back caused by insect attack, drought, or faulty soil conditions, a new and highly destructive disease has become established in the Gold Coast.

Observations made during a visit to the Gold Coast in the middle of the rainy season in 1941 showed that the first symptom is the appearance of a distinctive yellowish or whitish chlorosis in the leaves, the veins remaining outlined in normal green but appearing to be thickened underneath. Completely healthy-looking leaves are never afterwards produced, though the degree of chlorosis varies considerably in later flushes. Progressive defoliation ensues, and as the rate of leaf production is reduced the foliage tends to appear as small tufts at the ends of bare, whip-like branches. At this stage the whole appearance of the tree is yellowish. The swollen shoots themselves are later symptoms. They result from an increase in the width of the woody tissues, and are larger in chupons than in branches. Diseased trees also produce characteristic small, round pods. Die-back follows the defoliation, and although chupons may be produced from the trunk, the tree almost invariably succumbs within twelve months. In any one farm individual trees are affected first. From these the disease spreads in expanding circles until the whole area has been destroyed. Spread appears to be unaffected by the age or condition of the trees, the presence of overhead shade, or the type of soil.

The probability is that swollen shoot originated in the Nankase-Akodum district at least as early as 1930. The principal area of infection already extends to nearly 250 square miles, and the continuous nature of the cacao belt provides ideal conditions for spread. Probably two-thirds of the cacao in the centre of this area has now succumbed to infection, and in some of the villages stacks of cacao trunks are being sold as firewood.

Numerous isolated outbreaks have occurred in healthy cacao bordering the main area of infection. At Tafo, for example, nearly 70 individual outbreaks have been found in the past two years. Fortunately, in any one individual outbreak, the rate of spread, though steady, is not rapid; spread to a depth of three or four trees all round is probably the maximum in a year. Thirteen isolated outbreaks have been found in other parts of the Gold Coast. The most distant are at Wiawso in the Western Province and at Peki in the Eastern Province, across the Volta river. Unconfirmed reports from Africans state that the disease has appeared in French Togoland. The primary object of the Department of Agriculture is to confine the disease within the limits of the main area of infection and eradicate the isolated outbreaks as they are found. Such measures are at present severely handicapped by incomplete information about the distribution of infection, the alternate hosts of the virus, and the insect vectors.

WANG (Y. C.). **Rust reactions of Chinese Wheat varieties and certain Canadian hybrid strains.**—*Canad. J. Res.*, Sect. C, xx, 2, pp. 108–115, 1942.

Heavy losses in yield of wheat which amounted in some years to only 20 or 30 per cent. of that expected, are stated to be caused in Honan, northern China, by the rusts *Puccinia graminis tritici* [*R.A.M.*, xiii, p. 566], *P. triticina*, and *P. glumarum*, the two last-named being the most harmful.

In greenhouse and field experiments, about 200 Chinese spring and winter wheats (mostly varieties of *Triticum vulgare*, *T. turgidum*, *T. durum*, or *T. compactum* were tested for their resistance to races 9, 15, 19, 21, 34, 38, 51, and 56 of *P. graminis* and races 1, 9, 58, and 76 of *P. triticina*, while 75 lines of Canadian wheat from a cross between Renown Selection (resistant to *P. graminis*) and Garnet (resistant to *P. triticina*) were used in greenhouse tests with races 6 and 13 of *P. glumarum*. None of the Chinese varieties was resistant to all races of *P. graminis*, although some were resistant to one or more races. Among varieties of the *T. vulgare* group, none was resistant to more than three races of *P. graminis*; in the *T. durum* group and among the unidentified winter wheats the proportion of varieties with some degree of resistance was greater than in the *vulgare* wheats. More resistance was displayed by Chinese wheats to *P. triticina*, several *T. vulgare* varieties showing resistance to all the four races tested. There was evidence of mature plant resistance in some of the varieties.

Of the 75 lines of Canadian wheat tested, 25 were used with both races of *P. glumarum*, and five found to be resistant to both races, one moderately so, and seven resistant to race 13 and moderately resistant to race 6; of the remaining 50 lines tested with race 6 only, 20 were immune or resistant. Since all these lines are resistant to *P. graminis* and most of them also to *P. triticina*, as it was found in a field test, they are considered to represent valuable breeding material.

STRAIB (W.). **Physiologische Untersuchungen über Puccinia glumarum.** [Physiological studies on *Puccinia glumarum*.]—*Zbl. Bakt.*, Abt. 2, cii, 7–9, pp. 154–188; 10–11, pp. 214–239, 8 figs., 2 graphs, 1940.

A fully tabulated discussion is given of the writer's further studies at the Gliesmarode (Brunswick) branch of the Biological Institute on physiologic specialization in the yellow rust of cereals (*Puccinia glumarum*) [*R.A.M.*, xix, p. 77], with special reference to the environmental factors controlling uredospore germination.

Differences between the various physiologic races in respect of the rates of germination and germ-tube growth, temperature relations, morphology, and longevity are best discernible on a solid medium, such as 2 per cent. water agar. The presence of water in a fluid state is a prerequisite condition for the germination of the uredospores, which proceeds somewhat more rapidly in subdued daylight than in absolute darkness, but only at temperatures above 15° C., below which point no difference in the growth rate was perceptible. Generally speaking 9° to 11° may be regarded as the

optimum germination temperature, though equally satisfactory results may be secured with fully viable uredospores at a range of 2° to 15° or even up to 22° in the case of individual races. The maximum germination temperature for most races fructifying between 15° and 17° is from 23° to 25°, or rarely up to 28°. Some races respond favourably to the incorporation with the medium of 0·005 M. of the primary phosphates of ammonium, potassium, and calcium, which in such cases raise the temperature maximum by 2° to 3°. Similar but less marked effects are induced by organic sources of nitrogen, e.g., peptone and asparagin, but no such influence was exerted by cane sugar as a carbon source. At temperatures below 12°, carbonic acid in concentrations of 3 and 6 per cent., especially the latter, retards and reduces germination and materially curtails the length of the germ-tube, whereas at 17° to 19° the velocity and extent of germination are increased by the same compound at 4·5 per cent., though the reduction in germ-tube development persists.

The optimum hydrogen-ion concentration of the medium for germination ranges from P_H 5·5 to 6·5; at 4·5 germ-tube growth is substantially retarded but germinability is stimulated at 20°. In general, the minimum and maximum limits for uredospore germination in *P. glumarum* are P_H 3·1 and 8·5, respectively.

Reference has been made by other workers, notably Sapin-Trouffy (*Botaniste*, v, pp. 59–244, 1896) and Ezekiel [*R.A.M.*, x, p. 712], to the formation of apical vesicles and secondary hyphae on the germ-tube of *P. glumarum*. In the author's experiments this phenomenon was chiefly promoted by the maintenance of fructification and germination temperatures of 20° to 25° and 12° to 15°, respectively, and by an acid reaction of the medium (P_H 4·0), though it was also observed at temperatures just above freezing point. Different races vary in their propensity to the production of vesicles, which was mainly observed in race 23 from barley and race 7 from wheat. The secondary hyphae of the former proved to be much more resistant to extremes of temperature than the original germ-tubes, remaining viable for two months for instance, in a culture held just above freezing point.

Definite correlations exist between the germination rates and resistance to high temperatures of the individual races and their pathogenic properties, capacity to induce virulent infection on their hosts being associated with rapid germination and the ability to withstand heat. On an average the maximum temperature for the development of yellow rust infection lies 4° to 6° below that permitting uredospore germination. Absence of light does not preclude infection, which may take place in absolute darkness. Races of this type are ordinarily confined to regions in which high summer temperatures prevail, so that a selective action on physiologic specialization within *P. glumarum* may be attributed to climatic factors. Races of uniform virulence on a given host may be of different epidemiological importance on the grounds of their varying rates of uredospore germination and divergent reactions to high temperatures.

Bonne (C.). **Beitrag zur Flugbrandbekämpfung des Weizens. Untersuchungen zur Heisswasser-Kurzbeize.** [A contribution to the control of Wheat loose smut. Studies on the hot water short disinfection process.] —*Angew. Bot.*, xxiii, 5, pp. 304–341, 1 fig., 2 graphs, 1941.

In connexion with his experiments at the Strube-Schlanstedt seed selection establishment, Quedlinburg, Germany, on the control of loose smut of wheat (*Ustilago tritici*) by a short treatment with hot water, the writer has collected and summarized official reports on the economic importance of the disease in various parts of the world, from which the following inferences may be drawn. The disease is very prevalent in eastern Canada, where an incidence of 55 per cent. was recorded on wheat in 1934, but is steadily losing ground in the United States; substantial damage is caused by the smut almost every year in Uruguay and the Argentine [*R.A.M.*, xxi, p. 184], whereas in Chile it is practically unknown. In New Zealand loose smut infection of wheat and barley is regular but very slight, in New South Wales it was heavy on (?) wheat in 1933,

while elsewhere in Australia no significance attaches to the disease, the same being true of South Africa. Among European countries, France, Belgium, Rumania, and Hungary are widely affected, whereas in England, Denmark, Finland, and Italy the extent of infection is limited. As regards Germany, the writer in his travels throughout the country from 1935 to 1940 observed a rise in the incidence of loose smut both on wheat and barley, though the amount of infection on summer wheat never exceeded 10 per cent. According to statistics cited by Roemer [*et al.*: ibid., xviii, p. 195], *U. tritici* was responsible for 5·5, 5·0, and 3·6 per cent. of the total area rejected on account of disease in Germany in 1927, 1928, and 1938, respectively. Personal observations and experiments by the author demonstrated the importance of wind-borne infection in the dissemination of the disease, which is favoured by high temperatures and abundant atmospheric humidity, though the absence of these conditions, as for instance in 1935 and 1936, does not necessarily reduce the amount of loose smut to any appreciable extent. The necessity for the routine seed-grain disinfection of susceptible varieties is thus apparent.

The method of seed treatment finally adopted consists of two hours' continuous sprinkling with water treated to a temperature of 53° to 54° C. (8 l. per 100 kg.) in the Labor-Vorbereiter of the Miag-Braunschweig, a conditioning apparatus used in bakeries which has been described by Gehle (*Z. ges. Mühlenw.*, 4, 1930). By this means the incidence of loose smut in Red Schlanstedt summer wheat was reduced from 63 per cent. to nil in 1934–5. Discussing the mechanism underlying this method of treatment, the author considers that the intramolecular respiration of the seed is stimulated by the presence of water, the rapidly increasing warmth, and the exclusion of oxygen, all of which factors simultaneously promote the advance of the loose smut mycelium to an appropriate stage for response to the destructive action of high temperatures. In one experiment seed treated at 53° C. for two hours in the absence of air yielded four infected ears per 20 sq. m., whereas that treated similarly but in the presence of air yielded 37 ears in the same area.

Blair (I. D.). **Studies on the growth in soil and the parasitic action of certain Rhizoctonia solani isolates from Wheat.**—*Canad. J. Res.*, Sect. C, xx, 3, pp. 174–185, 1 pl., 1 diag., 1942.

In this study of some growth characteristics of *Rhizoctonia* [*Corticium*] *solani* in soil, it was found, by the effective use of an adaptation of the Rossi and Cholodny glass slide technique, that the extent of growth of 11 isolates of this fungus, after both 6- and 12-day periods, was less in a vertical than in a radial direction. Some isolates grew significantly faster than others. When one fast and one slower-growing isolate were grown at soil depths of 2, 4, and 6 in., it appeared that in all the soil mixtures used both grew best at the 2 in. level, less so at 4 in., and least of all at 6 in. It would seem that a low moisture content and good aeration prevailing at the upper soil stratum favour the growth of the fungus.

The results of pathogenicity experiments with ten isolates of the fungus on wheat showed a higher disease rating for all isolates in the unsterilized than in the steam-sterilized soil, and in the soil with a proportion of inoculum to soil of one to six than of one to three. The addition of 1 per cent. grass or straw meal to the unsterilized series reduced the amount of infection. There were two quite distinct types of symptoms: one, produced by two slow-growing isolates of English origin, was a form of root injury ranging in severity from a slight root tip necrosis to an extremely severe form resulting in almost complete destruction of the entire primary and secondary roots; and the other, produced by faster-growing isolates from Canadian sources, was characterized by brown lesions girdling the coleoptile above the kernel without any adverse effects upon the plant growth. It is thought that the English isolates may belong to a different species of *Corticium* altogether, but pending the discovery of their sporiferous stage, it is proposed to regard them as a variety of *C. solani*.

Carter (W.). **Peregrinus maidis (Aslim.) and the transmission of Corn mosaic. I. Incubation period and longevity of the virus in the insect.**—*Ann. ent. Soc. Amer.*, xxxiv, pp. 551–556, 1941.

A tabulated account is given of the writer's studies on *Peregrinus maidis* in relation to the transmission of maize mosaic [*R.A.M.*, xi, p. 591; xix, p. 556] at the Pineapple Experiment Station, Honolulu, Hawaii, the results of which showed that the normal incubation period of the virus in the leafhopper ranges from 11 to 29 days, the occasional occurrence of a phenomenally brief period in insects of related colonies being attributed to the influence of genetic factors. The virus persists in the leafhopper, and in the majority of cases is transmitted uninterruptedly to a series of plants when two-day feeding periods are allowed, but there were a few cases of breaks in the succession of positive transmittals, apart from those incidental to the death of the insect. Some of the leafhoppers lived for six days or more after the last positive transmission, with which the available virus supply was evidently exhausted. The latent period of development of mosaic in the maize plant was found to range from four days on young, vigorously growing plants, to 20 or over in those making slower progress.

Marchionatto (J. B.). **El 'verdin' del Maíz.** [The 'mildew' of maize.] –*Rev. Fac. Agron. B. Aires*, ix, 3, pp. 159–169, 2 col. pl., 4 figs., 1942. [English and Portuguese summaries.]

On various occasions since 1928 samples of maize infected by 'mildew' have been referred to the Argentine Ministry of Agriculture as the causes of poisoning in pigs and horses, and in 1940 a study was conducted on the etiology of the disease. Infected seeds are characterized by a greenish coloration of the scutellar region, which looks blue when viewed through the pericarp and has given rise to the common name of 'blue eye' in the United States [*R.A.M.*, xvii, p. 519]. The pericarp, intact at first, finally contracts and ruptures longitudinally, liberating a greenish powder consisting of the spores of the mould. Infection progresses from the enveloped cotyledon to the gemmule and radicle, and subsequently involves the entire embryo and the tissues underlying the endosperm, which ultimately become disorganized and emit an odour suggestive of alcohol. The cells of the embryonic tissues were found to be traversed in all directions by a very slender (2·5μ) hyaline mycelium, the fructifications produced by which were those of a typical *Penicillium*.

Of the four isolations of *Penicillium* and one of *Aspergillus* obtained from 117 mildewed maize samples, only two of the former reproduced the typical symptoms of the disease in inoculation experiments carried out along the same lines as Koehler's [loc. cit.]. Within the temperature range used for the tests (17° to 25° C.), moisture was the controlling factor in the development of mildew, the incidence of which extended from 42 to 68 per cent. at a relative humidity of 98 per cent. and fell to nil at 60 per cent.

The two pathogenic isolates, the cultural characteristics of which are described, were identified by C. Thom as strains of *P. viridicatum* [ibid., xiv, p. 237; xviii, p. 173].

Good results were obtained in laboratory experiments by dusting the infected seed-grain with Naaki (commercial crystalline silicon anhydride) at a concentration of 3 to 4 per cent. by weight. This substance absorbs moisture transpired by the stored grain and thus prevents the humidity which favours moulding.

Gonçalves (C. R.). **Observações sobre Pseudococcus comstocki Kuw., 1902, atacando Citrus na Baixada Fluminense.** [Observations on *Pseudococcus comstocki* (Kuw., 1902) attacking Citrus in Baixada Fluminense.]—*Rodriguésia*, iv, 13, pp. 179–198, 39 figs., 1940. [English summary.]

In Baixada Fluminense (States of Rio and Distrito Federal, Brazil), the roots of orange and grapefruit trees are extensively colonized by the mealy bug *Pseudococcus*

comstocki, over which a crust, up to 40 cm. in depth, is formed by a fungus identified by J. Rick as *Boletus tropicus*. The chestnut-coloured sporophores of the latter, 10 to 15 cm. in height and 5 to 25 cm. in diameter, appear on the surface of the ground immediately above the infested roots, to which the mealy bug is conveyed by the fire ant, *Solenopsis saevissima* var. *moelleri* Forel. On the foliage and branches of the trees *P. comstocki* also forms abundant colonies, again with the assistance of the ant and under the protection of a layer of sooty mould (*Capnodium*) or 'felt' (*Septobasidium pseudopedicellatum*) [*R.A.M.*, xx, p. 13]. The depredations of the mealy bug are most severe during the dry period from May to December. Measures for the direct control of subterranean infestation and for preventing the development of the insect, above and under ground, are described.

Milanez (F. R.). **Observaçoes sobre uma estranha doença das Laranjeiras.** [Observations on a strange disease of Oranges.]—*Rodriguésia*, iv. 13, pp. 199–263, 18 pl., 7 figs., 1940.

A full description is given of the writer's cytological examination of the Rangpur lime (*Citrus aurantifolia*) roots on which were grafted the orange trees suffering from the mealy bug (*Pseudococcus comstocki*) infestation [see preceding abstract]. The great majority of the roots were occupied by an endophyte [cf. *R.A.M.*, xv, p. 365] to which their actual death is attributed, the *Boletus tropicus*-mealy bug complex merely serving to weaken the tissues and facilitate the attack of the parasite. This is believed to be the first record of citrus mycorrhiza in South America. Attention is drawn in both these papers to certain analogies between the disease under observation and the vine and coffee maladies associated with *Bornetina corium* and *Polyporus coffeae*, respectively [ibid., xxi, p. 287].

Singh (L.), Singh (B.), & Khan (A. A.). **Citrus manuring. I. Fertilizer experiment with sweet Orange (Malta) growing on rough Lemon.**—*Indian J. agric. Sci.*, xi, 5, pp. 778–793, 1942.

In manurial experiments conducted from 1933 to 1938 at Lyallpur, India, it was observed that the lack of organic matter in the soil caused mottle leaf [*R.A.M.*, xix, p. 641] in Malta oranges (*Citrus sinensis*) growing on a seedling rough lemon (*C. limonia*) rootstock, both in the plots fertilized with varying amounts of ammonium sulphate and in the untreated control.

Fenton (F. A.) & Chester (K. S.). **Protecting Cotton from insects and plant diseases.**—*Circ. Okla. agric. Exp. Sta.* 96, 32 pp., 12 figs., 1 map, 1942.

Directions are given in popular terms for the control under Oklahoma conditions of cotton root rot (*Phymatotrichum omnivorum*) by crop rotation; of wilt (*Fusarium vasinfectum*) by the cultivation of such resistant varieties as Stoneville 2-B and Roldo Rowden and the use of a potash-containing fertilizer; and of bacterial blight (*Phytomonas* [*Xanthomonas*] *malvacearum*), the most prevalent disease in the State, by seed treatment with new improved ceresan or 2 per cent. ceresan (1½ and 3 oz. per bush., respectively, at a cost of 4 to 6 cents per bush.), or delinting with sulphuric acid (½ gal. per bush.) [*R.A.M.*, xxi, p. 252], combined with crop rotation. Seed treatment is also recommended for the control of boll rots [including *Glomerella gossypii*, *Gibberella fujikuroi* and *Corticium solani*: ibid., xxi, p. 196].

Progress Reports from Experiment Stations, season 1940–41.—216 pp., 9 graphs, London, Empire Cotton Growing Corporation, 1942.

These reports [cf. *R.A.M.*, xx, p. 402] contain, *inter alia*, the following items of interest. At Barberton, South Africa, the cotton was severely affected by premature leaf fall associated with *Alternaria* sp. [ibid., xix, p. 532]. The disease is confined to red loam soil at the Station, and all attempts to correlate its incidence with climatic

conditions and manurial treatments have so far failed, though fertilizer applications which have induced visibly better growth have retarded the onset of the condition. All varieties are affected, but the later-fruiting types hold out longer.

The progress report on plant pathological work at Barberton by G. M. Wickens (pp. 43–64) relates to the previous season (1939–40) and gives the results obtained in a further and more detailed and extensive survey of internal boll disease [*Nematospora gossypii* and *N. coryli*] and external or bacterial boll diseases [*Xanthomonas malvacearum* and organisms Y and G] in relation to insect vector activities and climatic conditions [loc. cit.]. The survey method proved valuable in defining the boll disease problems that would best repay intensive study, and in indicating those factors that exercise a strong controlling influence on the incidence of these diseases. The results obtained showed that the incidence of internal boll disease was slight, but that it increased progressively with lateness of boll formation, though it was less than was expected in the bolls formed last of all. The loss caused by the disease was considerably less than that caused by direct injury due to bug attack. As between different varieties of cotton the ratio of percentage loss of crop caused by bug feeding injury alone to percentage loss due to internal boll disease, with or without accompanying direct injury, did not vary appreciably. It therefore appears to be reasonable, in comparing varieties in their reaction to stainer populations, to take the figure for percentage loss of crop caused by direct injury and internal boll disease, together, as a comparative index of the incidence of either of the components, as well as an estimate of the absolute incidence of both together. The evidence also indicated that differences between strains and varieties in incidence of direct bug feeding injury and internal boll disease appear to be in conformity with the hypothesis that incidence is largely controlled by the measure of escape of the developing bolls from bug feeding; the earlier the fruiting habit of the plant, the greater is this measure of escape.

Data were obtained on the incidence of bacterial boll rots of two types, in which access to the lint was gained by (*a*) bacterial penetration through the boll wall, nearly always at the extreme base of the boll, and (*b*) through a channel at the tip of the boll which resulted from incomplete union of the carpels, the latter type being relatively very uncommon. It was apparent that the earliest bolls had suffered most; not only was the proportion of affected bolls higher in the earlier than in the later-formed groups, but also the extent of damage in affected locks was greater. As a result the crop on the late-fruiting plants heavily infested experimentally with bollworms [?*Heliothis armigera*] suffered less than that on the non-infested earlier plants, the figures for percentage of locks attacked and estimated loss of crop being respectively, 12·3 and 8·6 per cent. for the heavily infested plants, and 21·8 and 13·1 per cent. for the non-infested controls. Rainfall and humidity during the period of rapid boll growth are probably important factors, since except for the very late settings, the incidence of bacterial boll disease was positively correlated with rainfall during the formative periods of the bolls.

The incidence of external boll disease in the strains and varieties 9363, H. 19, B.P. 50/3, 0268, 6250, 5143, and 929 was determined in 24 plants of each variety. Indications were noted of some resistance in 6250, H.19, and B.P. 50/3.

In the more uncommon type *b* of external boll disease mentioned above, the incompletely joined carpels appeared to occur only in bolls that passed their early stages of development during exceptionally heavy rainfall. Some strains seem more apt to develop such malformations than others. In type *a* the fact that infection occurred nearly always at the extreme base of the boll, though occasionally elsewhere, may possibly be due to a particular susceptibility to infection of certain tissues in this region, or to the fact that at flower drop and for a day or two afterwards the calyx forms a cup round the base of the very young boll, in which drops of water, perhaps carrying bacteria, would easily lodge.

In early planted crops of normal growth in two seasons damage from type *a* disease

was greatest in the early formed bolls, which were subject during the early part of their development to heavier rainfall than those formed later. There is, however, some indication that crops weakened by drought may be badly affected by external boll disease. Such plants have thin boll walls, and there is reason to believe that thickness of boll wall may be an important factor governing extent of loss from this disease.

That data obtained from analytical survey methods of the kind reported in this paper may be adequately interpreted, studies should be instituted along the following lines, viz., (*a*) the feeding habits of stainers and pentatomids of all instars, particularly their choice of food when flowers and bolls of all ages are freely available, (*b*) the reaction of bolls of all ages to bug feeding, (*c*) the reaction of bolls of all ages to infection by internal boll disease, and (*d*) the efficiency of all instars of stainers and pentatomids as vectors of internal boll disease. Satisfactory methods for (*a*) and (*b*) already exist and have been used by Rainey and Pearson. With regard to (*c*) the author has found the following technique to be both simple and effective. 'Sterile' stainers reared in cages on dry cotton seed from sterile bolls and water made available on a continuously moist cotton wick were converted into vectors of internal boll disease by replacing for a few days the wick by another moistened with a heavy aqueous suspension of spores of *N. gossypii* obtained from young artificial cultures on potato dextrose agar. Stainers so treated, and then at once caged singly on sterile bolls two or three weeks old for a few days, regularly produced infection, which was confirmed by microscopic examination of every affected lock.

In February, 1940, an outbreak of cotton wilt occurred in one field at Barberton, and a fungus corresponding generally with *Verticillium dahliae* was isolated from diseased material. Infection was characterized by extensive vascular browning readily apparent on removal of leaves, conspicuous mottling of leaf laminae markedly different from that of normal leaf senescence, premature leaf fall, and dwarfed growth of green younger leaves.

At Bremersdorp, Swaziland, most of the loss of crop was due to bacterial boll rot in the early bolls, while *Alternaria* was prevalent early, especially on granite soil.

In Southern Rhodesia, probably owing to the short rainy season, there was little angular leaf spot [*X. malvacearum*] and no sign of blackarm.

In the Gezira (Anglo-Egyptian Sudan) selection work for leaf curl resistance was continued. Of 2115 selected M.S.D.S. (Massey's Selected Domains Sakel) plants (87/39, 123/39, 133/39, 142/39, and N.T. 97/40), 99 became affected, and of 2,305 controls 220 showed the disease. The general mean number of infected plants per line was 1·43 for the selections and 3·19 for the controls.

At Shambat Sub-Station, the propagation in bulk of the first trial lots of blackarm-resistant Sakel cotton has permitted the work of the Station to be extended. This bulked fifth back-cross material was of typical N.T. 2 appearance, and preliminary small-scale spinning tests gave satisfactory results. This material is to be followed by seventh back-cross strains of N.T. 2 and X. 1730 type homozygous for resistance, seed for the propagation of which has been secured. As a precautionary measure, crossing has been continued to the ninth back-cross. A new blackarm resistance factor, B_3, has been isolated from *Gossypium punctatum*, and is being transferred to both Sakel and American cottons. Experimental evidence demonstrated that a strain of cotton resistant to leaf curl in one area is not necessarily resistant in another.

To prevent deterioration due to seed admixture and outcrossing in blackarm-resistant Sakels, the *arboreum* gene for red flowers and foliage has been incorporated in resistant strains now ready for bulk propagation.

Momtaza bamia (*Hibiscus esculentus*), a selection moderately resistant to leaf curl and Egyptian bollworm, has been propagated in bulk, and is rapidly replacing the local crop.

In district variety trials in Uganda the mean blackarm lesions per plant shown by

a local variety, B.P. 52, B. 181, and X. 3, were 2·58, 2·33, 0·5, and 1·85, respectively, B. 181 being significantly better than the other varieties at all centres. At Kawanda, following severe hail storms, blackarm was more prevalent than usual. The sporadic appearance of *Verticillium* wilt [*V.* ? *dahliae*: ibid., xix, pp. 342, 646] made it very difficult to estimate varietal differences in susceptibility. A new technique to ensure even infection by wilt was devised. Seed was germinated, and the seedling uprooted before any root hairs had developed and dipped in a liquid culture of the fungus. The plants were then placed in banana fibre pots, and when they had become established, the bottom of each pot was removed, and the whole planted out in the field. Among varieties to which this treatment was applied, the U.S.A. strain Delfos 4 was outstanding for resistance, while B.P. 50 was again very susceptible.

Di Fonzo (M.). **Las enfermedades del Algodonero en la República Argentina.** [Cotton diseases in the Argentine Republic.] —*Bol. Junta nac. Algodón, B. Aires*, 80, pp. 951–978, 27 figs. (23 col.), 1 diag., 1941.

This useful survey of the symptomatology, etiology, mode of propagation, economic importance, and relationship to environmental factors and control of cotton diseases in the Argentine includes observations on angular leaf spot (*Phytomonas malvaceara*) [*Xanthomonas malvacearum*], anthracnose [*Glomerella gossypii*], sore shin (*Corticium vagum* or *Rhizoctonia solani*) [*C. solani*], wilt (*Fusarium vasinfectum*), boll rots associated with various organisms, e.g., *Monilia sitophila*, *Rhizopus nigricans*, *Cephalothecium* [*Trichothecium*] *roseum*, and *Aspergillus niger*, rust [*Cerotelium desmium*], crown gall (*Bacterium tumefaciens*), sooty mould (*Capnodium* sp.), yellow mosaic, and ring spot. A separate section is devoted to the question of seed treatments.

Langford (G. S.), Vincent (R H.), & Cory (E. N.). **The adult Japanese Beetle as host and disseminator of type A milky disease.**—*J. econ. Ent.*, xxxv, 2, pp. 165–169, 1942.

Laboratory studies at the University of Maryland and field observations in various parts of the State have shown the Japanese beetle [*Popillia japonica* Newn.] to be (1) a host of the milky disease (type A) [*Bacillus popilliae*: *R.A.M.*, xxi, p. 78], (2) a factor in the spread of the causal organism, and (3) a possible medium for the propagation of spores for use in the artificial dissemination of infection. Evidence of (1) was afforded by the presence of the disease in an adult reared from a larva developing in infested soil and in adults reared from inoculated larvae or inoculated with spores of the bacillus; of (2) by the discovery of milky disease in adults collected in the field and the development of infection among larvae held in soil mixed with spores from diseased adults; and of (3) by the ready development of infection in inoculated adults.

Davis (B. L.), Smith (Ruth T.), & Smith (C. E.). **An epidemic of coccidioidal infection (coccidioidomycosis).**—*J. Amer. med. Ass.*, cxviii, 14, pp. 1182–1186, 1942.

In May, 1940, seven out of 14 university students and faculty members contracted infection by *Coccidioides immitis* on a field trip to a region contiguous to the San Joaquin Valley, California. All the invalids and two of the others, who had apparently been immunized by previous infection, were subjected to a heavy exposure of dust from the soil, from which the fungus was recovered. Moderately severe symptoms, of three to six weeks' duration, accompanied the infections in six out of the seven cases, but none of the patients developed coccidioidal granuloma.

Elles (Norma B.). **Rhinosporidium seeberi infection in the eye.** —*Arch. Ophthal., N.Y.*, N.S., xxv, 6, pp. 969–991, 1 col. pl., 5 figs., 1941.

In connexion with a case of ocular rhinosporidiosis, *Rhinosporidium seeberi*, in a 14-year-old boy in Texas, the third recorded in the United States [cf. *R.A.M.*, xix, p. 218], the writer critically discusses the causal organism in its taxonomic, morphological, historical, histopathological, etiological, clinical, and therapeutic aspects, gives

particulars of its occurrence in animals, cultural and experimental work, and geographical distribution, and fully reviews the relevant literature.

Pratt (H. N.) & Roorbach (Carolyn L.). **Species specificity of Alternaria in asthma and hay fever.**—*J. Allergy*, xii, 5, pp. 431–437, 4 diags., 1941.

At the Children's Hospital, Boston, 28 patients were tested by the intracutaneous method with four species of *Alternaria* from (1) carnation blight, (2) dying geraniums, (3) decaying squash (all from the Massachusetts Agricultural Experiment Station), and (4) air of the city. All the children except one reacted to all four *A.* spp. but usually failed to respond to other fungal genera; the 28th patient remained insensitive to one species throughout the tests. Of 13 adults subjected to similar tests at the Massachusetts General Hospital with *A. circinans* [*A. oleracea*], *A. solani*, *A. geophila*, *A. radicina*, *A. mali*, and *A. iridis*, seven reacted strongly to all six species, three to five, one to three, and two to two. These results indicate that species of *Alternaria* of divergent biological origin and varying morphological characters contain a common atopic excitant, but *in vivo* and *in vitro* experiments afforded only partial confirmation of this hypothesis. The fact that a species from the air and that isolated from squash, both heavy spore-producers, neutralized the reagins to all the others tested suggests that the conidia are the principal part of the mould concerned in the etiology of respiratory allergy.

Pratt (H. N.), Colmes (A.), Fromer (J.), Greene (J. E.), Chafee (F. H.), & Clapp (W. B.). **Pollen and mold survey of southeastern New England—1940.**—*New Engl. J. Med.*, ccxv, 14, pp. 533–538, 7 graphs, 1941.

Unlike the plant pollens concerned in the production of respiratory allergy in south-eastern New England, *Alternaria* [see preceding abstract] can be cultured from the air of Boston throughout the year, though the heaviest contamination coincides with the warm weather period, commencing in July and culminating in late September.

Dillman (A. C.) & Stoa (T. E.). **Flax seed production in the north central States.**—*Fmrs' Bull. U.S. Dep. Agric.* 1747, 19 pp., 9 figs., 1 graph, 1 map, 1942.

The following notes on flax diseases in the north-central States of North and South Dakota, Minnesota, and Montana are contained in this bulletin, which supersedes No. 1328 in the same series (1935). Control of wilt [*Fusarium lini*] by the cultivation of such resistant varieties as Bison, Buda, Linota, and Redwing is now generally practised, and one of the aims of breeders should be the combination of resistance to wilt with a similar reaction in respect of rust [*Melampsora lini*], from which most strains of Argentine, a few of Indian, Newland, Ottawa 770 B, Cirrus, and a group of hybrids are immune. Argentine varieties appear to be particularly susceptible to 'pasmo' [*Sphaerella linorum*: *R.A.M.*, xxi, p. 246], the introduction of which into new territory by way of the seed should be avoided as far as possible.

Ferguson (W.). **Sleepiness in Carnations.**—*Sci. Agric.*, xxii, 8, pp. 509–518, 4 figs., 1942.

Investigations conducted in Ontario, Canada, indicated that sleepiness of cut carnations, a disorder characterized by partial to complete closing of the flower from which there is no recovery, is probably not due to faulty cultivation, but rather caused by some factor during transportation. It was observed that carnations stored in the presence of ripe apples become sleepy, and it was tentatively suggested that this is caused by ethylene given off by the fruit. In tests with pintsch gas (containing ethylene), which is used in the lighting and cooking fixtures of trains, exposure to a concentration of 100 p.p.m. (equivalent to 16 p.p.m. of ethylene) for 24 hours caused sleepiness in all but one carnation after two days, and to one of 250 p.p.m. (equivalent to 40 p.p.m.) for 10 hours made 8 out of 12 carnations sleepy after 6 days. Both con-

centrations were within the figures obtained for analyses of gas samples from express trains. It is suggested that sleepiness might be prevented by using air-tight, ventilated containers for package. Another line of control was indicated by the fact that no sleepiness developed when carnations were exposed to pintsch gas at a temperature of 43° to 45° F. It is thought possible that there is a critical temperature below which the gas is not harmful to carnations.

Dodge (C. W.). **Helminthosporium spot of Citronella and Lemon Grass in Guatemala.**—*Ann. Mo. bot. Gdn*, xxix, 2, pp. 137–140, 1 pl., 1942.

Helminthosporium cymbopogi Dodge n. sp. is the name applied to the causal organism of a foliar spot of citronella (*Cymbopogon nardus* subsp. *genuinus*) and lemon grass (*C. citratus*) on a large plantation on the coastal plain below Escuintla, Guatemala. The spotting begins with the formation between the veins of small, yellowish areas, which elongate into elliptical or nearly linear, necrotic, red-bordered lesions similar to those of *H. sacchari* [cf. *R.A.M.*, xx, p. 229] on sugar-cane; the central portion soon turns brown and shrivels but does not drop out. With an increase in the number of spots wilting of the distal part of the leaf ensues, followed by death.

The conidiophores of the fungus, which was easily isolated on Thaxter's potato glucose agar and developed equally well on Sabouraud's glucose agar, are stiff, erect, of a smoky to dark brown colour, simple, and bear singly or in small groups, terminally and laterally (apically only on the host) tri- to quinqueseptate, asymmetrical conidia, measuring 24 to 35 by 8 to 15·5 (average 29·5 by 12·4) μ from *C. nardus* and 19·5 to 28·6 by 7 to 15 (25·8 by 10) μ from *C. citratus*, these dimensions being somewhat smaller than those of the spores on the host (46 to 54 by 18 to 24 (49 by 20) μ). In the original cultures on potato glucose agar, the large subterminal cell of the conidium often proliferated laterally, producing an organ suggestive of the staurospore of *Triposporium*, but this type of growth did not occur in subcultures. Spore germination is effected by means of a tube from the basal cell which either penetrates between the epidermal cells and then enters them or produces a dichotomously branched mycelium.

Preliminary experiments indicate that the leaf spot may be combated by spraying with Bordeaux mixture or lime-sulphur, but a more promising approach to the problem of control, in view of the prohibitive cost of fungicidal treatments, lies in the selection of resistant clones, and measures in this direction are already in progress.

Wilkinson (E. H.). **Dieback and canker of Apple branches caused by a Gloeosporium sp.**—*Gdnrs' Chron.*, Ser. 3, cxi, 2896, p. 269, 2 figs., 1942.

In 1941 and 1942 Cox's Orange Pippin and Laxton's Superb apple trees at Bidford-on-Avon, Worcestershire, were attacked by severe die-back and canker. Infection had taken place through summer pruning cuts in 1941. The trees had been planted in 1935 on land previously heavily manured for vegetable cultivation. In 1940, the trees were summer-pruned, and slight die-back occurred; the operation was repeated in 1941, and a very high proportion of the cuts became infected. All trees allowed to go to grass and not summer-pruned remained unaffected. Infected material showed the presence of a *Gloeosporium*, possibly *G. fructigenum* [*Glomerella cingulata*]. Inoculations of three- to five-year-old twigs of Cox's Orange Pippin gave typical symptoms, the fungus being re-isolated from the cankers. The disease is occasioned by summer pruning and injudicious manurial treatment, the former being the more important factor. Affected branches should be removed and burnt and winter substituted for summer pruning. Apples left on the trees or lying on the ground should also be removed and burnt.

Wormald (H.). **A stalk-end rot of Apples.**—*Gdnrs' Chron.*, Ser. 3, cxi, 2891, p. 220, 1942.

In August, 1941, the author received two apples grown in a Surrey garden and

affected with a stalk-end rot, one of which showed the presence of *Botrytis cinerea* [*R.A.M.*, xx, p. 169] while the other bore the pycnidia of a species of *Phoma*, with cylindrical spores, rounded at the ends, measuring about 7 by 3 μ, extruded in yellowish-brown globules. A further lot of apples from the same garden also showed the presence of the same fungi, and in addition another species of *Phoma* which later produced white, curled tendrils of small spores. The two species of *Phoma* have not yet been identified. When grown in pure culture and inoculated into mature apples taken from storage they readily caused infection.

Hopperstead (S. L.) & Kadow (K. J.). **How to reduce spray injury losses on the Peninsula.**—*Trans. Peninsula hort. Soc.*, xxxi, 4, pp. 39–40, 1942.

Spraying tests conducted during the past four seasons in Delaware [apple] orchards demonstrated that much of the fruit russet that developed was due to the use of liquid lime-sulphur in combination with lead arsenate during the calyx and first cover periods. Copper materials applied before the pubescence was off the young fruits also caused much russet. Russet and leaf injury were produced by the use of insoluble coppers without lime or with fixed nicotine materials; with fixed nicotines the injury was greater. When the insoluble coppers were used with lime, they were as safe as Bordeaux mixture (1–3–100). Bordeaux mixture (3–5–100) badly damaged fruit varieties susceptible to injury by copper. The insoluble coppers were inadequate to control arsenical injury, reduced codling moth [*Carpocapsa pomonella*] control, and failed to give satisfactory control of bitter rot [*Glomerella cingulata*].

The evidence obtained indicated that liquid lime-sulphur should not be used after the bloom period and should never be combined with lead arsenate. Milder sulphurs, such as the paste sulphurs, are recommended, and if applied thoroughly and promptly give perfect control of scab [*Venturia inaequalis*]. Copper sprays should not be applied to young apples before the pubescence has gone, as any injury to it will appear as russet later. As a rule, copper materials are safe in the third cover spray. For the best control of arsenical injury during summer and for the control of the usual summer diseases, Bordeaux mixture 1–3–100 in every spray, or 2–4–100 in alternate sprays, is the most effective material. When bitter rot presents a problem, it may be necessary to use Bordeaux mixture at a concentration of 4–4–100, the concentration required depending on the susceptibility of the variety to the disease, the severity of infection, and the tolerance of the variety to copper.

The best and safest schedule appears to be: sulphur paste during the scab season whenever possible, or liquid lime-sulphur in the pre-bloom sprays and sulphur pastes during the rest of the scab schedule. From the third cover spray onwards, Bordeaux mixture (1–3–100) should be included in every spray, or 2–4–100 in every alternate spray, as necessary. Individual instances may arise when the 1–3–100 concentration may be applied in alternate sprays only. If bitter rot is a problem, the concentration of the Bordeaux mixture must be increased.

Wilson (E. E.). **Experiments with arsenite sprays to eradicate Sclerotinia laxa in stone-fruit trees as a means of controlling the brown rot disease in blossoms.**—*J. agric. Res.*, lxiv, 10, pp. 561–594, 2 figs., 4 graphs, 1942.

Calcium, zinc, and sodium arsenite sprays were tested in about 161 trials from 1938 to 1940 for the control of *Sclerotinia laxa*, the fungus almost exclusively responsible for serious blossom blight (brown-rot disease) [*R.A.M.*, xxi, p. 27] in apricots, almonds, plums, and prunes in California. The conidia borne on the sporodochia of the fungus are stated to be the primary inoculum for blossom infection in the spring, since no apothecial stage of the fungus has been found in the State. The sprays were applied at the period of maximum sporodochial development, which, though varying somewhat from year to year and from district to district, extended from early January

to late February. The best control was obtained with calcium arsenite, which at the rate of 4 lb. per 100 gals. water reduced sporodochial development by 98 to 99 per cent., while rates of 3 and 2 lb. per 100 gals. were somewhat less efficient, and even at 1 lb. per 100 gals. eradicatory effects were noticeable though not always consistent. The higher concentrations proved, however, too injurious, particularly to almonds, and the safest concentration for all fruits is considered to be 2 or possibly $2\frac{1}{2}$ to 100. The addition of petroleum-oil emulsion to calcium arsenite sprays increased their eradicant properties (particularly of the 2 and 1 to 100 concentrations); whilst oil added in large quantities (4 per cent.) increased injuriousness to apricot trees; and Bordeaux mixture and zinc-lime, at concentrations of 8–4–100 or 4–2–100, decreased both the eradicant and the injurious effects of the lower concentrations of calcium arsenite, but affected only slightly the 4 to 100 concentration.

Zinc and sodium arsenite sprays were both inferior to calcium arsenite and the second of the two proved too injurious to trees when used in its most effective concentration.

Cultures made from blighted twigs sprayed with calcium arsenite showed that the mycelium of the fungus had been killed, probably by the water-soluble arsenic in the spray. Arsenite sprays applied to the trees after large numbers of sporodochia had developed were less consistently effective than were those applied earlier in the season. Thus, in 1938, calcium and zinc arsenite sprays (both at the rate of 3 lb. to 100 gals.) applied in February killed a high percentage of conidia borne on sporodochia; but in 1939, January sprays effectively destroyed the conidia then present, while February sprays killed only the outermost conidia, and did not penetrate deeper into the tightly packed mass of conidial chains. Lack of sufficient rainfall to liberate soluble arsenic is believed to be responsible for this low toxicity. Observations in experimental orchards showed that on the whole suppression of sporodochial development by arsenite sprays resulted in marked reduction in disease. Blossom infection was reduced by calcium arsenite sprays by 70 and 77 per cent. in 1938; 91 and 96 per cent. in 1939; and 85, 91, 97, and 98 per cent. in 1940. Results obtained with zinc and sodium arsenite were less consistent. Control of blossom blight obtained with calcium arsenite compared favourably with that obtained with Bordeaux mixture applications in spring or both calcium arsenite and Bordeaux treatments combined. However, the arsenite spray is not intended to replace but to supplement Bordeaux. Injury to the tree following arsenite sprays may develop from the entry of arsenic into wounds, leaf scars, buds, or dead twigs. In almond, which proved hypersensitive even to the lowest concentrations, arsenic may penetrate through uninjured bark. Apricots and the plum varieties tested were more tolerant, the former suffering injury only where high concentrations were used or the sprays applied soon after pruning or leaf fall. Concentrations of 2 and 3 lb. to 100 gals. seemed safe when applied in midwinter. Injury can be considerably reduced by delaying pruning till after spraying or by postponing it until midwinter when the leaf scars have healed.

Jeffers (W. F.) & Darrow (G. M.). **Promising Strawberry crosses resistant to the red stele disease.**—*Trans. Peninsula hort. Soc.*, xxxi, 4. pp. 20–23, 1942.

Of some 10,000 strawberry seedlings tested in the past three years in a co-operative project between the United States Department of Agriculture and the University of Maryland for the production of varieties resistant to red stele [*Phytophthora fragariae*: *R.A.M.*, xxi, p. 86], about 2,300 were selected for resistance. Most of these have been tested for two years in soil in which susceptible varieties die, and 95 reserved for further testing. At the U.S. Horticultural Station, 18 of the selections found to be immune when experimentally inoculated were fruited in 1941, and four hybrids were selected as commercially promising, all being crosses between Aberdeen and Fairfax. Several thousand plants of these selections were propagated for further tests. Although many desirable hybrids have been obtained, it is thought that further breeding may produce even better selections.

Of particular interest among the hybrids kept for further experiment was a cross between a Scottish selection known as BK–46 and Fairfax. This, which proved to be a very good selection, does not have Aberdeen as a parent. Of interest also are Aberdeen × Mastodon selections, which are the first highly resistant ever-bearers that merit further testing. Several selections of Aberdeen × Blakemore almost equal Blakemore in quality. Of hybrids grown on the Eastern Shore the most promising are four crosses between Aberdeen × Fairfax and one between Aberdeen × Dorsett.

Miller (P. A.). **Phytophthora crown rot of Loquat.**—*Phytopathology*, xxxii, 5, pp. 404–409, 3 figs., 1942.

In 1939 two 11-year-old loquat trees, one of the Early Red and the other of the Advance variety, at the University of California, Los Angeles, were observed to be suffering from a crown rot attributable to spontaneous infection by *Phytophthora cactorum*, previously recorded as a pathogen of the same host in Japan but not hitherto described as a natural parasite of loquats in the United States [*R.A.M.*, xii, p. 594; xvii, p. 253]. Primary symptoms of the disease on the Early Red tree included the development on the bark of irregular, necrotic lesions, fuscous brown to fuscous black (Ridgway) on the surface and Prout's to mummy-brown beneath, followed at an advanced stage of infection by desiccation, cracking, and sloughing-off of the affected portions, while secondary features of the disease were the progressive yellowing and shedding of the foliage and the general decline of the tree. The brown streaking of the cambial region and the strong odour of fermentation of the diseased cortex characteristic of the loquat crown rot were also mentioned by Baines as associated with a collar rot of apples caused by the same fungus [ibid., xviii, p. 807].

P. cactorum was isolated by four different methods from the diseased loquat tissues, and pure cultures from potato dextrose agar inoculated with positive results into watermelon, apple, and quince fruits and loquat seedlings, the last-named developing typical cankers. Effective control was afforded by decortication in the early stages of the disease, removing the dead bark within the lesions and the sound cortex 1 to 1½ in. beyond their margins, followed by the application with a brush to the treated areas of a wash consisting of ½ oz. dry Bordeaux mixture in a pint of water.

McClellan (W. D.). **Temperature as it affects spore germination in the presence of copper and sulphur.**—*Phytopathology*, xxxii, 5, pp. 394–398, 1 graph, 1942.

At the New York (Cornell) Agricultural Experiment Station the writer observed the effect of temperatures between 6° and 33° C. on the toxicity of copper sulphate to the conidia of *Sclerotinia fructicola* and *Alternaria solani* and the uredospores of *Uromyces caryophyllinus* and of a proprietary particulate sulphur (Walco Products, Inc., 512 Greenwich St., New York) to the conidia of *S. fructicola*, *Venturia inaequalis*, and *Sphaerotheca pannosa* var. *rosae*. Both preparations were least effective against the several fungi at approximately the optimum temperature for the germination of their spores, a result agreeing with the conclusion of Clark (*J. phys. Chem.*, v, pp. 269–316, 1901) and Brooks (*Bot. Gaz.*, xlii, pp. 359–375, 1906). In practice, the time required for killing a pathogen at temperatures below the optimum for that organism would probably be longer than that required above the optimum and the toxic agent should usually be applied at the higher temperatures. In the case reported by Smith [*R.A.M.*, ix, p. 393] sulphur was effective in controlling *S. fructicola* on peaches at 40° to 55° F. but not at 65° to 85°, temperatures approximating the optimum for this fungus.

Parker-Rhodes (A. F.). **Studies on the mechanism of fungicidal action. II. Elements of the theory of variability. III. Sulphur.**—*Ann. appl. Biol.*, xxix, 2, pp. 126–135; 136–143, 1 diag., 1 graph, 1942.

In the second contribution to this series [*R.A.M.*, xxi, p. 150], the author defines variability as a parameter equal to the variance of the αth power of the variate,

divided by the square of α and of the mean of the αth power of the variate. It is mathematically expressed as $W_\alpha(x) = V(x^\alpha)/\overline{\alpha^2 x^{\alpha^2}}$, and it is deduced that $W_0(x) = V(\log x)$. The index of variation is defined as the quantity α in the definition of variability, cited; it is assumed that there exists a value of α such that the αth power of the variate is normally distributed. The variability is estimated by a statistical equation, which refers to the tolerance of a given spore, defined as that concentration which just suffices to prevent that spore from germinating. On the basis of these mathematical equations, it is deduced that the variability of the tolerance of a given population of fungal spores is less to any permeative compound than to a non-permeative one of the same element, unless it undergoes one or more reactions on the surface of the spore with some constituents of the spore secretion, and the greater the number of such successive reactions that are required to bring it to permeable form, the greater the variability will be. It is further deduced that instability on the part of a given compound increases the apparent value of the variability of the spores to it; that the variability of the spores to any compound is proportional to the square of the number of atoms of the effective element in a molecule of that compound, and that the index of variation is inversely proportional to that number, provided only one compound is permeative; and finally, that the variability to a compound, which had undergone molecular dissociation into parts, some of them permeative, will be proportional to the number of parts into which it dissociates, and the index of variation inversely proportional to that number. It is believed that most kinds of synergism, occurring between constituents of a mixture used in experiments or between a compound under test and any product formed therefrom as a result of its toxic action, might interfere with the results by increasing the apparent value of variability.

The third contribution deals with the reaction of spores of *Macrosporium* [*Stemphylium*] *sarciniforme* to a selection of sulphur compounds (flowers of sulphur, sodium dithionite, sodium sulphite, sodium dithionate, sodium tetrathionate, sodium thiosulphate, and sodium sulphate), applied as spray solutions. Hydrogen sulphide was used in the form of mixtures with air, a geometrical series of which was prepared with the aid of a special apparatus. These mixtures were found liable to decomposition by atmospheric oxidation when brought into contact with water, the figures obtained indicating that the reaction follows an essentially unimolecular law. It is concluded from the results of this study that only certain sulphur ions (containing two sulphur atoms to the ion) can penetrate the spore wall of the fungus, e.g., hydrodisulphide, dithionite, and perhaps pyrosulphite, or if only one such ion is permeative, thiosulphite. Of the two isomeric forms, a yellow and a colourless one, presumed to exist in certain ions with two sulphur atoms, it is believed that only the latter can be absorbed. It is suggested that sulphur exerts its effect indirectly through the pyrosulphoxylate ion present in the hydrolysate. It is pointed out that the results do not depart significantly from the predictions of the theory of variability.

Gunesch (W. E.). **Tear gas treatment of soil.**—*Canning Age*, xxiii. 5, p. 272, 1942.

Two drawbacks still attend the commercial use of chloropicrin for the control of plant pathogens in the soil [*R.A.M.*, xx, p. 582], one being the lack of a reliable machine for its application and the other the reluctance of growers to handle a preparation which is liable to cause a certain amount of discomfort to the inexperienced. These disadvantages, however, should not be allowed to outweigh the great utility of the chemical for the treatment of hot-bed, cold-frame, or outdoor plant-bed soils. Using $2\frac{1}{2}$ c.c. for each injection on 10 to 12 in. centres, about 420 lb. per acre is required. At the present price of 80 cents to $1·25 per lb., the treatment of 1 sq. ft. of soil costs roughly 1·6 cents. The chemical reaches a depth of 4 to 8 in. The soil temperature must be maintained at upwards of 60° F. and the amount of moisture moderate.

Heuberger (J. W.) & Horsfall (J. G.). **Reduction in fungicidal value of copper compounds by organic materials.**—*Phytopathology*, xxxii, 5, pp. 370-378, 1942.

At the Connecticut Agricultural Experiment Station the writers conducted a laboratory study on the effects of various organic materials used as spreaders on the fungicidal value of copper sulphate, Bordeaux mixture, copper oxychloride, and red and yellow cuprous oxides.

Judged by their toxicity to *Macrosporium* [*Stemphylium*] *sarciniforme* [*R.A.M.*, xix, p. 665], the copper compounds were adversely affected at a uniform point (LD 50, representing the lethal dose for 50 per cent. of the spores) by materials containing substantial amounts of protein, e.g., derris and pyrethrum powders [ibid., xx, p. 488], soy-bean flour, and lucerne meal, whereas no deleterious action was exerted by activated charcoal and maize starch, the protein contents of which are negligible. The reduction in fungicidal value by protein-containing substances is tentatively attributed to a reaction between the toxic copper and the protein diminishing the amount of the former available for spore destruction.

Hyre (R. A.). **Relation of particle size to fungicidal value and tenacity of two 'insoluble' copper fungicides.**—*Phytopathology*, xxxii, 5, pp. 388–393, 1 fig., 1942.

In a laboratory study at the Tennessee Agricultural Experiment Station on the relationship of particle size to the fungicidal value and tenacity of four samples of copper carbonate and two of tri-basic copper sulphate, gauged by the toxicity of these compounds to the spores of *Macrosporium* [*Stemphylium*] *sarciniforme* [see preceding abstract], both the properties under investigation were found to increase *pari passu* with a decrease in the dimensions of the constituent particles [*R.A.M.*, xviii, p. 538; xxi, p. 341]. The mean Bordeaux coefficients of the coarse, medium, and fine fractions of copper carbonate, with particle sizes of 2·06, 1·17, and 0·83 μ, respectively, were 0·160, 0·391, and 0·534, respectively, and the tenacity coefficients of the three fractions 0·393, 0·512, and 0·608, respectively, compared with 0·769 for Bordeaux mixture. For tri-basic copper sulphate with particle sizes of 4·07 and 2·54 μ, respectively, the Bordeaux coefficients were 0·181 and 0·266, respectively, and the tenacity coefficients 0·301 and 0·507, respectively, compared with 0·842 for Bordeaux mixture.

Rangel (E. D.). **Contribuição para o glossário português referente á micologia e á fitopatologia.** [Contribution to a Portuguese glossary embracing mycology and phytopathology.]—*Rodriguésia*, iv, 12, pp. 67–116, 1939.

This revision of the author's glossary of Latin or Latinized mycological and phytopathological terms and their Portuguese equivalents embodies corrections and additions to the first list [*R.A.M.*, x, p. 743].

Brewer (J. H.). **A new Petri dish cover and technique for use in the cultivation of anaerobes and micro-aerophiles.**—*Science*, N.S., xcv, 2475, p. 587, 1 fig., 1942.

The new Petri dish cover described in this note for use in the surface cultivation of anaerobes and micro-aerophiles is so designed that most of the flat portion is depressed and touches the agar at the periphery, trapping a small amount of air over the agar surface. A reducing agent is added to the agar medium employed and this uses up the oxygen in this small amount of air, while the glass rim of the depressed portion of the cover forms a seal with the moist solidified agar.

Armitage (F. D.). **The rotting of the litho damping rollers.**—*Patra J.*, v, 5, pp. 83–86, 1942. [Abs. in *Bull. Inst. Pap. Chem.*, xii, 10, pp. 318–319, 1942.]

A species of *Sporotrichum* was found to be responsible for the rotting of the soft rubber, moleskin, and felt coverings of the damping rollers of an offset lithographic machine, the same fungus being also present in the new felt stocks examined. The rubber was very heavily infected and quickly contaminated any new felt and moleskin

coverings fitted on to the machine. Temporary control was effected by washing the rubber rolls with an aqueous solution of methyl para-hydroxybenzoate, but a complete removal of the rubber covering was eventually found to be necessary.

Mushin (Rose). **Serological studies on plant viruses.**—*Aust. J. exp. Biol. med. Sci.*, xx, 1, pp. 59–63, 1942.

Using a modified form of Chester's precipitin titration technique [*R.A.M.*, xiv, p. 781], the author conducted at the University of Melbourne a serological study on the following 11 viruses: ordinary tobacco mosaic, tobacco aucuba mosaic, tomato bushy stunt, potato virus X, potato virus X+B (Bawden), potato aucuba mosaic, tuber blotch (Loughnane and Clinch) [ibid., xxi, p. 265], potato spindle tuber, tomato spotted wilt, rose wilt [ibid., x, p. 733], and strawberry crinkle, of which the two last-named and potato spindle tuber were propagated in their own hosts and the remainder in tomato.

Four of the viruses tested gave no precipitin reactions, viz., potato spindle tuber, tomato spotted wilt, rose wilt, and strawberry crinkle. The results obtained with the tobacco mosaic viruses, tomato bushy stunt, and potato virus X were in general agreement with those of other workers. The precipitin titre of the potato X+B complex was $\frac{1}{256}$, the corresponding figures for potato aucuba and tuber blotch being $\frac{1}{16}$ and $\frac{1}{4}$, respectively. Cross-precipitin tests showed that, of the viruses tested, only the two strains of tobacco mosaic were serologically related. Precipitin titres of tobacco aucuba mosaic and potato virus X in different parts of tomato plants indicated that the maximum concentration of both viruses resides in the leaves and lowest in the stems and petioles, the results in respect of the first-named agreeing with those of Matsumoto and Somazawa [ibid., xii, p. 598].

The different viruses were found to yield characteristic types of precipitates, those of the ordinary and aucuba mosaics of tobacco being abundant and light in texture, that of potato virus X still light in texture but less abundant, the floccules of potato aucuba mosaic rather coarser than those of X, and the particles of tomato bushy stunt tightly aggregated. The author agrees with Bawden and Pirie [ibid., xvii, p. 566] that the tomato bushy stunt floccules resemble those obtained with bacterial 'O' antigens, while the tobacco mosaic and potato virus X precipitates conform to the 'H' type and further suggests the inclusion in the latter group of potato aucuba mosaic.

Investigations on the field methods of precipitin testing devised by Chester [ibid., xvi, p. 767] and Dounin and Popova [ibid., xvii, p. 762] showed the former to be reliable when the optimum antigen-antibody flocculation ration was applied, while the latter yielded inconsistent results.

Dodge (B. O.). **A note on segregation types in Glomerella.**—*Mycologia*, xxxiv, 2, pp. 219–221, 1942.

The author suggests possible explanations of origin of 'light' and 'dark' races in *Glomerella* in the light of results recently reported for *Paramecium*.

Daines (R. H.), Campbell (J. C.), & Martin (W. H.). **Three years' comparisons of dusts and Bordeaux spray for Potato production in central Jersey.**—*Amer. Potato J.*, xix, 5, pp. 90–96, 1942.

Of the various plant protectives tested on Irish Cobbler potato crops during the period from 1938 to 1940 at the New Jersey Agricultural Experiment Station, New Brunswick, Bordeaux mixture 10–10–100 gave the best control of late blight [*Phytophthora infestans*], and in the phenomenaliy dry season of 1940 it also acted as an effective insect repellent. At the same time, the foliage of the plants treated with this preparation remained green longer than that of any of the others, although this effect was not reflected in an increased yield. In 1938, when both flea-beetles [*Epitrix*

cucumeris] and late blight were severe, the Bordeaux-sprayed plots outyielded those treated with 30–70 copper-lime dust (469 and 446·3 bush. per acre, respectively); in 1939, a season of severe insect infestation, the copper-lime dust treatment was more effective (191·1 bush. per acre compared with 171·3 for Bordeaux mixture) and in 1940 the yields in both series of plots were approximately equal.

Nattrass (R. M.). **Potato blight.**—*E. Afr. agric. J.*, vii, 4, pp. 196–201, 4 figs., 1942.

The climatic conditions prevailing in Kenya, where potato blight (*Phytophthora infestans*) was first observed in 1941, permit of continuous cultivation of the host in one stage or another, so that the problem of the overwintering of the pathogen does not arise. Kerr's Pink, the favourite variety in the colony, is reputed to be fairly resistant to blight, but it sustained heavy damage in the 1941 epidemic; certain 'native' varieties, such as Nyakinongo and Kiraya, withstood the disease much better, but others, e.g., Misimaa and Nyakahoro, are highly susceptible and should be excluded from the vicinity of the main crop, since they might well constitute the focus of an attack. Directions are given for the preparation of Bordeaux and Burgundy mixtures, of which the latter will probably be preferred for use in the Colony, where good-quality lime is not easily obtainable.

White-Stevens (R. H.). **Boron deficiency on Long Island.**—*Bett. Crops*, xxvi, 2, pp. 6–9, 42–46, 6 figs., 1942.

Following a general discussion on the effects of boron deficiency on plants, with special reference to Long Island soil conditions, the writer cites some data obtained in experiments on the amelioration of the disorders resulting from this shortage in particular crops. Swedes suffering from brown heart [*R.A.M.*, xx, p. 518] were found to require 20 lb. borax per acre for the control of the disease, while up to 50 lb. could be given with safety. Over a three-year average the percentages of brown heart in the check plot and those receiving 1, 5, 10, and 20 lb. borax per acre were 72, 38, 9, 6, and 4, respectively, the corresponding figures for black canker in beets [ibid., xxi, p. 114] being 33, 23, 13, 11, and 9 respectively, and for hollow heart in cauliflowers [ibid., xxi, p. 113], 65, 32·1, 17·1, 3·3, and 0·7, respectively. In connexion with the last-named disease, the soil reaction was found to play an important part in determining the extent of the damage from boron deficiency, which was estimated (by means of a grade index, 0 = no injury) at 0·44, 0·40, 0·40, and 0·20 in plots receiving borax at P_H 4·7 to 5·0, 5·0 to 5·5, 5·5 to 6·0, and 6·0 to 7·1, respectively, the corresponding figures for the untreated controls being 2·8, 1·9, 1·4, and 0·9, respectively. Since potatoes require only small amounts of boron and suffer from its excess, the cauliflower crops preceding them (the usual local rotation) should be treated as conservatively as possible.

Orsini (G.). **A bacterial soft rot of Capsicum fruits.**—*Int. Bull. Pl. Prot.*, xxxiii, 3, pp. 33M–36M, 1942.

In November, 1939, a field of *Capsicum annuum* plants at Todi, Perugia, showed the presence of a bacterial soft rot. The disease attacked the pods at any stage of ripening and in any part, usually the base of the peduncle. In a few days the whole fruit was affected, and a dense, viscid, evil-smelling liquid accumulated in the tip. Affected unripe pods showed an olive-brown spot which spread through the entire healthy tissue in eight or nine days; on ripe, yellow or red pods, the infected area showed softening but no colour change.

The parenchymatous tissue broke down into a shapeless, soft mass, while the epidermis remained unaffected, but stretched under the weight of the liquid accumulated in the tip of the fruit, which assumed the shape of an inverted cone. Later, the epidermis became ruptured, and the liquid was discharged, frequently infecting pods lower down. The liquid contained myriads of very mobile bacteria measuring 1 to

1·5 by 0·3 to 0·5 μ, and almost in pure culture. This liquid, extracted with a syringe from the interior of a fruit having an intact epidermis, when inoculated into a sound fruit, reproduced the disease in four to five days. The organism differed entirely from *Bacillus coli* var. *capsici* Passalacqua, *B. capsici* Pavarino & Turconi, and *Bacterium vesicatorium* [*Xanthomonas vesicatoria*] and could not be considered identical with *Bact. briosii*. It showed, however, some affinity with *Bact.* [*Pseudomonas*] *syringae*, of which the author considers it to be a new variety which he names *Bact. syringae* var. *capsici* n. var. [without a diagnosis], chiefly characterized by its non-pathogenicity to lemon, lilac, and pear.

Three seasons' observations indicated that attack occurs in autumn after a cold wet spell. The best means of control would appear to consist in harvesting the last crop when the autumn rains start, even if the pods are not ripe, provided they fulfil trade requirements. All diseased fruits and crop trash should be burnt.

Müller (A. S.) & Texera (D. A.). **La mancha blanca del Ajanjoli.** [The white spot of Sesame.]—*Agricultor venez.*, v, 57–58, pp. 47–49, 3 figs., 1941.

The white to grey, sharply delimited spots, 1 to 2 mm. in diameter, produced by *Cercospora sesami* on sesame foliage and pods [*R.A.M.*, xx, p. 450; xxi, p. 44] in Venezuela number 100 to 400 per leaf. Under humid conditions, such as prevail in the States of Aragua, Carabobo, Miranda, and Distrito Federal, the disease may assume a severe character, involving premature defoliation and reducing the yield of seed. In trials at the El Valle Agricultural Experiment Station, the plants raised from seed sown on 15th September, 1939, were sprayed four times at monthly intervals with bordinette [ibid., xvii, pp. 486, 635] at the rate of 1 kg. per 100 l. In counts made during January, 1940, the numbers of spots on the large, medium-sized, and small leaves were 50, 10, and 6, respectively, the corresponding figures for the controls being 170, 75, and 25, respectively.

Bisby (G. R.), Mason (E. W.), & Wakefield (E[lsie] M.). **A note on nomenclature.**—*Mycologia*, xxxiv, 2, pp. 215–217, 1942.

This paper refers to the nomenclatural results of the discovery that S. F. Gray's 'Natural arrangement of British Plants' is later than Volume I of Fries's Systema. The start of nomenclature of 'fungi caeteri' from the date of publication in Systema I, II, and III is favoured instead of the proposal to start with 1st January, 1821.

MacMillan (H. G.) & Plunkett (O. A.). **Structure and germination of Septoria spores.**—*J. agric. Res.*, lxiv, 10, pp. 547–559, 2 pl., 1942.

A study of the spores of *Septoria apii-graveolentis* [*R.A.M.*, xviii, p. 780] from cultivated and escaped celery, the results of which have a bearing on the structure of other species of this genus, showed that the spores are mature when they consist of four cells, and are three-septate. The term 'septate' is here used to imply septation in the spores of this fungus caused by the abutting plasma membranes of contiguous cells within the integument, no true septa being present; this is shown by heating and drying the spores when the protoplasts draw away from each other and from the spore wall. Spores with five or seven septa were occasionally found, but spores with an even number of septa were abnormal. Germination of the spores is accompanied by cell proliferation, usually by division of the end cells of the spores. The appearance of the cell contents was observed to change with progressive stages of germination, larger globules developing apparently as a result of agglutination of the original smaller ones. The term 'guttula', as encountered in descriptive mycological literature, is determined in the case of the *Septoria* spores as 'bright spots produced by lens action on the clear portions within the cells of the spore'; it is not considered a safe basis for specific differentiation.

The examination of a number of fungi now regarded as species of *Septoria* leads the authors to believe that those characterized by shorter and wider spores and with one

or two septa are probably misclassified. It is pointed out that observations on spores of species of *Septoria* made in the bright field of the microscope are not sufficient, and that the spore structure is revealed more completely in the dark field.

Padwick (G. W.). **The genus Fusarium. VI. A recent attempt at mass revision.**—*Indian J. agric. Sci.*, xi, 5, pp. 663–674, 1941.

The author reviews the history of the sections *Elegans*, *Lateritium*, and *Liseola*, and is especially concerned with the fate of the species as proposed in Snyder and Hansen's 'The species concept in *Fusarium*' [*R.A.M.*, xix, p. 495]. These authors regard all the so-called species of the section *Elegans* as one species, but at the same time consider the major grouping of the species into sections to be correct. Dr. Padwick does not accept either conclusion. He holds that species should not be studied merely *in vitro* and in pathogenicity tests, and thinks a new taxonomy can only safely be based on field work directed to establishing species with an ecological and even geographical distribution.

Mrak (E. M.), Phaff (H. J.), & Smith (B. L.). **Non-validity of the genus Asporomyces.**—*Mycologia*, xxxiv, 2, pp. 139–141, 1942.

The imperfect yeast genus *Asporomyces*, originally described by Chaborski and tentatively retained by Ciferri and Redaelli [*R.A.M.*, viii, p. 677] and by Lodder [ibid., xiv, p. 193] in their keys to the family Torulopsidaceae, is considered invalid on the following grounds. The formation of abortive conjugation tubes, which was given as the main diagnostic character of the genus, was observed in a number of other yeasts and is apparently not restricted to a single genus or family. Nor is it considered a reliable morphological character, as it does not appear to occur regularly or under a given set of conditions. It is concluded, therefore, that the genus *Asporomyces* is no longer acceptable even in a tentative manner. *A. uvae*, described by Mrak and McClung, should be transferred to *Torulopsis pulcherrima* as suggested to the authors by T. Hof. The true identity of the type species, *A. asporus* [loc. cit.], which was lost and is therefore not available for comparison, remains doubtful, but its fermentation characters are stated to be similar to those of *T. californicus*. A revised version of Lodder's generic key to the Torulopsidoideae is given.

Jenkins (Anna E.) & Bitancourt (A. A.). **Myriangiales selecti exsiccati, Fascicle 1.**—*Mycologia*, xxxiv, 2, pp. 214–215, 1942.

In a short note on this fascicle, issued from São Paulo in 1940, the authors state that it is based on a previous paper by themselves [*R.A.M.*, xix, p. 366]. It contains 50 specimens, issued in 10 sets, all of which, with the exception of two bearing the date 1925, were collected between 1931 and 1940 in South America. Two sets have already been deposited in the Farlow Cryptogamic Herbarium and the herbarium of the New York Botanical Garden.

Karling (J. S.). **A synopsis of Rozella and Rozellopsis.**—*Mycologia*, xxxiv, 2, pp. 193–208, 1942.

Following the recent critical discussion of the genus *Rozella* and the erection of the new genus *Rozellopsis* [*R.A.M.*, xxi, p. 351], the author presents a complete list of known species of these two genera, which at present number fifteen in the first and four in the second. The following parasitic species are of interest: *Rozella irregularis* on *Pythium vexans* and *P. monospermum*; *R. cuculus* on *Pythium* sp., *P. intermedium*, and *P. monospermum*; the two new species, *R. laevis* on *P. gracile*, and *R. barrettii* on *Phytophthora cactorum*; *Rozellopsis inflata* on *Pythium intermedium*; and *R. waterhouseii* on *Phytophthora cryptogea* and *P. megasperma*.

Lange (J. E.). **Flora agaricina danica. Vols. I–V.** [Danish agaric flora. Vols. I–V.]—550 pp., 200 col. pl., Copenhagen, Recato A/S, 1935–1940. Kr. 400.

This work, described by the editors as 'a new standard iconography of Agarics', has been issued under the joint auspices of the Society for the Advancement of Mycology in Denmark and the Danish Botanical Society, and comprises chromolithographic plates illustrating some 1,200 species, reproduced from the author's original paintings, now in possession of the Botanical Museum of the University of Copenhagen, accompanied by a set of keys and full descriptions of the morphological characters of the fungi under discussion.

Allard (H. A.). **Infectivity of extracted, unpreserved Tobacco mosaic virus retained 28 years.**—*Science*, N.S., xcv, 2471, p. 479, 1942.

A portion of tobacco mosaic virus filtered through filter paper was kept in a tightly corked vial on a shelf at room temperature from 1914 until 1936, when it was found to be as infectious as when first extracted. In 1942, it was again tested, by inoculation into 20 small Connecticut Broadleaf [tobacco] plants, being rubbed on the glandular trichomes of the leaves on 27th February. The first symptoms appeared on 7th March on nine plants, and the remainder showed mosaic on 9th March. The P_H of the virus in 1942 was ascertained to be 6·76. Dried and ground leaf material obtained from affected tobacco in 1915, and stored in a jar at room temperature was no longer infectious in 1936.

The author's observations indicate that the retention of virulence of extracted, unpreserved sap depends upon the type of fermentation that occurs in the infected material, one type resulting in acid conditions being destructive to the virus and the other with a near neutral reaction favouring prolonged virulence.

Berkeley (G. H.). **Tobacco mosaic in Ontario and Quebec.**—*Sci. Agric.*, xxii, 8, pp. 465–478, 1942.

The results of investigations conducted from 1935 to 1939 in Ontario and Quebec, Canada, showed that contaminated soil and smoking or chewing of tobacco by the workers while handling the growing crop of tobacco, are the most important primary sources of infection with the virus of tobacco mosaic [*R.A.M.*, xix, p. 371]. The virus was shown to overwinter in the soil and to infect the crop of the following year. Thus, 17 per cent. infection occurred in the plot where tobacco followed tobacco whereas none was observed on new ground; only 2 per cent. developed on the plot from which the tobacco plants of the previous year were pulled up instead of ploughed under. The survival of the virus in the soil was more pronounced in Ontario than in Quebec, where as little as 0·5 to 2 per cent. infection was observed in fields after crops having as much as 40 to 50 per cent. mosaic. The virus was readily recovered in quantity from samples of contaminated Ontario soils each month from October to July inclusive during two seasons, but none was obtained from Quebec soils after November in the first season and only in small amounts up to May in the second. The reason for better survival of the virus in Ontario soils is as yet obscure. The results of four years' tests indicated that it is unsafe to replace rogued mosaic plants with healthy ones as the latter contracted from 11 to 72 per cent. infection. Tobacco plants grown in soil into which infected trash had been incorporated showed between 30 and 55 per cent. infection, while none developed on soil that had not grown tobacco for two years.

High percentages of infection (up to 100 per cent.) resulted from transplanting with unclean hands after handling infected material or when tobacco was smoked or chewed during the operation. As much as 6 per cent. infection was observed when manufactured cigarettes were smoked and from 4 to 88 per cent. when the workers rolled their own cigarettes. Little or no infection occurred when the hands were thoroughly washed with soap under running water or in a solution of trisodium phos-

phate [ibid., xx, p. 498]. The presence of as few as 10 diseased among 200 transplanted seedlings resulted in 75 per cent. infection, indicating that a small amount of infection in the seed-bed may give rise to comparatively high incidence in the field. Roguing following three cultivations reduced the infection in the field from 40, 66, and 94 per cent. to 4, 10, and 19·9, respectively. Infection was increased by cultivation from 2 to 68 per cent. When rows of healthy plants were cultivated immediately following rows of infested ones, they contracted 4 per cent. infection under dry conditions, but as much as 75 per cent. when the plants were heavy with dew. In a similar test, 2 per cent. infection followed cultivation in dry, sunny weather, and 30 per cent. in rain. When plants were topped indiscriminately in the row, percentages of infection ranged from 7 to 78, whereas when all healthy plants were topped first, leaving diseased ones for later, infection was reduced to from 3 to 36 per cent.

The following conclusions are drawn for the control of tobacco mosaic: soil for seed-beds should be sterilized and only clean seed used; hands, clothing, and tools should be cleansed thoroughly before handling seedlings and no tobacco should be chewed or smoked while working; tobacco should be rotated with some other crops such as rye; roguing of diseased plants should be undertaken before each cultivation, which should preferably be carried out under dry conditions; and healthy plants should be topped before diseased ones.

HILL (A. V.) & ALLAN (F. E). **Yellow dwarf of Tobacco in Australia. III. Occurrence and effect of agronomic practices.**—*J. Coun. sci. industr. Res. Aust.*, xv, 1, pp. 13–25, 1 graph, 1 map, 1942.

In this further account of studies on tobacco yellow dwarf in Australia [*R.A.M.*, xx, p. 604] it is stated that the disease occurs in southern Queensland, New South Wales, Victoria, and South Australia, but has not been reported from Western Australia, Tasmania, or the northern and coastal districts of Queensland. In Victoria and the Tamworth area of New South Wales it is economically important every year.

An examination of the weather conditions prevailing in the different areas concerned failed to show any outstanding differences in temperature and rainfall that might help to explain differences in prevalence. However, dry hot conditions during and following transplanting appear to favour spread and the early development of symptoms. Small, rapidly growing plants appear to be highly susceptible, and symptoms may be more clearly defined after showery weather than at other times. Infection may occur at any growth stage, but losses are highest when the plants are attacked shortly after transplanting.

Five years' observations in different districts indicated that source of seed does not affect the amount of disease in the field. Some varietal differences in susceptibility were observed, but were peculiar to localities and seasons and there was no indication that any variety was inherently less susceptible than others. Seed-bed infection did not appear to be important. No significant effects on incidence were attributable to fertilizer treatments or soil type. In general the greatest differences in percentage infection were between different districts in any one season, and between different seasons. In some seasons, early- and late-planted crops are less affected than the rest, probably because the early ones have grown sufficiently to resist the worst effects of the disease, and because the late ones escape attack. The chief infective period does not occur at the same time every year; in 1939–40 it was in December, but in several other years in November. After the main infective period is over, comparatively few plants are attacked. Time of planting cannot, however, be relied upon as a means of avoiding infection, but the available evidence suggests that late-planted crops are usually less affected than early-planted ones. It might be practicable to develop an early-maturing variety that could be planted late enough to escape the worst infection period.

Rawlings (R. E.). **Observations on the cultural and pathogenic habits of Thielaviopsis basicola (Berk. & Br.) Ferraris.**—*Ann. Mo. bot. Gdn*, xxvii, 4, pp. 561–598, 3 pl., 10 graphs, 1940.

The author describes in detail the cultural and morphological characteristics of three isolates of *Thielaviopsis basicola*: A from tobacco, Tennessee, B from *Primula obconica*, Holland [*R.A.M.*, xii, p. 513], and C from cotton, Texas. These were found to be distinct physiologic races: A was strongly pathogenic to tobacco, groundnuts, and watermelon, but less so to cotton and *Primula obconica*; B severely damaged watermelon, attacked cotton more and *Primula obconica* and groundnuts less strongly than A, and failed to infect tobacco; C was only weakly pathogenic to cotton, groundnuts, and watermelon, and unable to infect tobacco and *Primula obconica*. A was quite constant in culture, C extremely variable, and B intermediate. Chlamydospore production by A was materially reduced at P_H 7 and 8 whereas B and C were only slightly affected. The endospores of A were smallest (11·9 by 4·2 μ), B the largest (15·6 by 4·7 μ), and C intermediate (13·9 by 4·3 μ). The chlamydospore chains of A were often borne in large clusters, those of B in groups of 1 to 3, and those of C singly or in pairs. The chlamydospores of A averaged 7·6 μ in length, B 9·0 μ, and C 7·5 μ.

Diachun (S.), Valleau (W. D.), & Johnson (E. M.). **Relation of moisture to invasion of Tobacco leaves by Bacterium tabacum and Bacterium angulatum.**—*Phytopathology*, xxxii, 5, pp. 379–387, 2 figs., 1942.

Trials were carried out at the Kentucky Agricultural Experiment Station to determine the capacity of *Bacterium tabacum* [*Pseudomonas tabaca*] and *Bact. angulatum* [*P. angulata*] on the surface of moist Burley tobacco leaves to infect the foliage in the absence of water-soaked tissue.

No infection occurred either in the greenhouse or field when a suspension of *P. tabaca* was placed on the leaf surfaces; that is to say, the bacteria did not swim through the stomata to attack the underlying tissues. Positive results were obtained, however, by the application, even for periods of a few minutes, of suspensions of both organisms to the surface of water-soaked foliar tissues, as well as by pouring the inoculum on to the surface of leaves previously sprayed (but not water-soaked) with sterile water. No infection resulted if the inoculum was applied after water-soaked tissues had lost the water-soaked condition. These results are interpreted as implying the dependence of bacterial infection of tobacco on the existence of open stomata and a liquid passage between the outer leaf surface and the intercellular tissues, in the absence of which forcible injection of the organisms through the stomata is essential to successful invasion [*R.A.M.*, xix, pp. 124, 440.] The excess internal liquid may or may not be sufficient to induce water-soaking and it need only be present for a few minutes. These conditions are not satisfied with every rain and unless they are infection does not occur even in the presence of the pathogens on the leaves.

Hochapfel (H.). **Die Wurzelphloemnekrose der Tomate.** [Tomato root phloem necrosis.]—*Zbl. Bakt.*, Abt. 2, cii, 10–11, pp. 262–269, 4 figs., 1940.

Observations in 1935, 1938, and 1939 on a phloem necrosis of outdoor tomato roots, causing appreciable losses in nurseries in the Breslau district of Germany, indicate that the adverse effects of low soil and atmospheric temperatures are primarily responsible for the disorder, the presence of *Colletotrichum atramentarium* on the diseased material being without etiological significance. The condition, which may develop either before or after transplanting, involves the outer phloem ring, especially the medullary ray and inner bark parenchyma, the resulting necrosis impeding the exchange of nutrients between the xylem and phloem. Generally speaking, the external symptoms of 'chilling', i.e., wilting and death of the plants, do not become apparent until June or July, so that the histological disturbances remain latent for a period of one to three months. Growers are advised to protect the seedlings thoroughly

against cold in the greenhouse and frame, and not to transplant them until the soil temperature rises above 5° C.; in 1938 the mean minimum for May was only 3·8°.

Cox (C. E.). **The performance of the Pan America Tomato on Fusarium wilt infested soil.**—*Trans. Peninsula hort. Soc.*, xxxi, 4, pp. 84–85, 1942.

In a test carried out in Maryland in 1941, the Pan-America tomato resistant to wilt (*Fusarium bulbigenum* var. *lycopersici*) [*R.A.M.*, xx, p. 607; xxi, p. 393] was grown with the Rutgers and Brown's Special varieties in a plot which had grown tomatoes in four of the past five years but which, because of the disease, had failed to produce a profitable crop during that period.

The first count made on 6th August revealed that Pan-America had a stand of 91·1 per cent., with no plants showing wilt symptoms, Rutgers one of 77·5 per cent., with 7·1 per cent. wilt, and Brown's Special one of 74·4 per cent., with 56·7 per cent. wilt. At the final count, on 11th September, Pan-America showed 90·7, Rutgers 73·8, and Brown's Special 56·9 per cent. stand. The yield of marketable fruit for the three varieties was 2·93, 3·73, and 1·07 tons per acre, respectively, many fruits of Pan-America failing to reach marketable size. In a garden on the same farm 152 Pan-America plants growing under better conditions yielded at the rate of 18·5 tons per acre of marketable fruit.

Pan-America appears to be more resistant to wilt than any other commercial variety at present available. The fruit produced in the test was of excellent quality but rather smaller than that of the commonly accepted varieties used locally for canning.

Moore (W. D.). **Some factors affecting the infection of Tomato seedlings by Alternaria solani.**—*Phytopathology*, xxxii, 5, 399–403, 1942.

Humidity was found to be the principal factor affecting the incidence of tomato leaf spot (*Alternaria solani*) infection in Georgia, where large-scale production of seedlings for transplantation to the north is carried out [*R.A.M.*, xix, p. 440], the number of hours per diem in which the atmosphere approaches saturation being apparently of more importance than the daily mean relative humidity over any given period. Under such conditions the amount of infection increases with rising mean temperatures (within the ranges of 54° to 62° and 74° to 82° F. in these experiments), though appreciable damage may occur in much cooler weather than that represented by the ordinary daily mean for the Tifton area of southern Georgia.

In 1937, 1938, and 1940, when field infection by *A. solani* was mild, the number of days and the mean number of hours per day with upwards of four hours of 90 to 100 per cent. relative humidity ranged from 3 to 8 and 6·5 to 9·3, respectively, in March (20th to 31st), 14 to 18 and 6·7 to 8, respectively, in April, and 5 to 10 and 5 to 7·6, respectively, in May (up to 20th), whilst in 1939, which was marked by a severe epidemic, the corresponding figures for March were 11 and 11·6, for April 25 and 10·8, and for May 19 and 10·2, respectively.

Both the leaf spot and stem canker phases of the disease are liable to be intensified by the unavoidable mechanical injuries incidental to the processes of pulling and packing the seedlings while the humid atmosphere induced in the crates by the wet peat moss used for transport is likewise conducive to the spread of infection.

Beattie (J. H.), Beattie (W. R.), & Doolittle (S. P.). **Production of Tomatoes for canning and manufacturing.**—*Fmrs' Bull. U.S. Dep. Agric.* 1901, 15 figs., 1 map, 1942.

The section of this bulletin (superseding No. 1233 in the same series) on tomato diseases and their control comprises popular notes on a number of well-known disorders of the crop and their preventive or curative treatment.